REPORT

OF THE

CANADIAN ARCTIC EXPEDITION
1913-18

VOLUME V: BOTANY

PART C: GENERAL OBSERVATIONS ON THE VEGETATION

By FRITS JOHANSEN

SOUTHERN PARTY—1913-16

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By FRITS JOHANSEN

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PREFACE

This report is an attempt to give a general description of the vegetation along the western arctic coast of America, based upon my work during the Canadian Arctic expedition, 1913-16. It is supplementary to the two preceding parts of this volume, and the scientific names used are in accordance with them.

On the way into the Arctic, natural history collections and observations were made at port Clarence,[1] on Bering strait (See Vol. III. Part K, pp. 4-5; and Vol. VII, Part N., pp. 3-4), though not enough to warrant the inclusion of a description of the coast south of point Barrow in this report. For a description of the topography and the vegetation of this part of the arctic coast I refer to Beechey's "Narrative of a voyage to the Pacific and Bering strait, 1825-28, London, 1831," and particularly to B. Seeman's general description in "Botany of the Voyage of H.M.S. *Herald*, under the command of Captain H. Kellett, during the years 1845-51, London, 1852." More recent descriptions are found in F. C. Schrader and W. J. Peters: "A Reconnaissance in Northern Alaska, Professional Paper No. 20, U.S.G.S. Washington, 1904," A. H. Brooks: "Geography and Geology of Alaska, Professional Paper No. 45, U.S.G.S. Washington, 1906," and J. Muir: "The Cruise of the *Corwin* 1881. New York, 1917."

As the north coast of Alaska is very uniform as to topography, geology, and natural history all the way to Mackenzie delta, it has not been considered necessary to subdivide it according to longitude. Owing to our wintering 1913-14 at Collinson point in Camden bay and extensive travelling eastward and westward along the coast and up some of the rivers, it has been possible to write special chapters dealing with the topography of the different natural areas in this region from the mountains to the sea, as well as to give a summary on the climate, based upon our meteorological observations, with particular reference to plant life. The vegetation on this part of the coast is treated in detail.

The vegetation on the low cape Bathurst peninsula is interesting enough to call for special mention based upon investigations there in July, 1916; and the same is the case with Young point south of Amundsen gulf, where observations were made in the same month. An original, general description of the topography of the coast around Franklin bay, supplied by Dr. R. M. Anderson, is also given, based on work in that region from 1909 to 1912.

As the Southern party of the Canadian Arctic expedition had its headquarters for almost two years (end of August 1914 to middle of July 1916) at Bernard harbour, on the south side of Dolphin and Union strait, detailed investigations of the vegetation, insect life, climate, etc., were possible all the year round in that vicinity. A detailed topographical map of the harbour was also made (See Figure 2); but as this will be followed up with topographical and geological descriptions in Vol. XI of the Report of the Canadian Arctic expedition, it is sufficient to give only the general features in this paper, in connection with the vegetation examined. The description takes in both the mainland coast and the islands alongside and farther off shore, a particularly interesting subject from the point of view of vegetation, exhibiting as these islands do, all stages from a barren reef of boulders or sand and gravel to larger islands with almost the same number of plants as upon the mainland. A special chapter on the climate at Bernard harbour, with particular reference to the vegetation, is given, being a summary of the meteorological observations made during our stay there.

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[1] For a description of port Clarence, see also A. E. Nordenskiold: "The Voyage of the *Vega* round Asia and Europe," New York 1882, p. 569.

A general description of the topographical and geological features of the Coronation gulf region has been supplied by Dr. R. M. Anderson, who visited this area during three summers. In addition, I have added two chapters on the topography and vegetation along the south and west sides of Coronation gulf, including the lower Coppermine river and some of the islands in the Duke of York archipelago. These chapters are based mainly upon information gained on two sledge trips in the wintertime, and on observations and collections of plants made by Messrs. J. R. Cox and J. J. O'Neill.

Finally, a chapter on the topography and vegetation of Wollaston peninsula, Victoria island, is given, based mainly upon observations and collections of plants made by Mr. D. Jenness and myself in 1915 and 1916. To this a summary of the bedrock vegetation from Stapylton bay eastward to Bathurst inlet, including Wollaston peninsula, forms a natural appendix.

In my two reports already published (Vol. VIII, Part K, General Observations on Insect Life in the Arctic, and Vol. VII, Part N, The Crustacean Life of Some Arctic Lagoons, Lakes and Ponds) a number of data, among them many botanical records of importance for the understanding of the invertebrate life on land and in fresh water will be found. As these two reports belong to the same series as this one, it has not been considered necessary to reprint the data.

The author desires to acknowledge his indebtedness to the different persons whose assistance has made the writing and publishing of this report possible. First of all to the members of the scientific staff of the expedition, who went to the trouble to collect plants at places which the author did not have the opportunity to visit himself, and to whose friendly interest he owes much. Secondly, to the Deputy Minister of Naval Service in Ottawa, Mr. G. J. Desbarats, under whose direction the expedition was sent out and carried through. Thirdly, to the chairman of the Arctic Publications Committee, Prof. E. E. Prince, for continual scientific support. The author is also indebted to the late Mr. James M. Macoun for the preliminary identification of the flowering plants collected during the expedition, and to the officials of the Herbarium of the Smithsonian Institution in Washington for a supply of pressing paper and advance information about collecting plants in Arctic America, given in 1913.

In judging the present report it should be remembered that the author also was responsible, during the expedition, for the collecting and study of insects, fishes and all kinds of marine and freshwater invertebrates, as well as for hydrography; and that biological observations ranked only second or third among the objects of the expedition. It is his hope, however, that this report which, so far as he knows, is the first attempt at a detailed description of the vegetation along a considerable part of the American arctic coast, may be of value to the botanist and geographer alike, as well as to the general reader whose interest in the Arctic regions he believes is steadily growing.

OTTAWA, February 5, 1923.

FRITS JOHANSEN.

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The Vegetation of the Arctic Coast Between Point Barrow, Alaska, and Bathurst Inlet, N.W.T.

By Frits Johansen

EXPLORERS

The explorers and expeditions who have investigated or visited the arctic coast between point Barrow, Alaska, and Bathurst inlet, N.W.T., and who have made collections of plants, are as follows:—

1. John Franklin, etc., 1821. (Coppermine river to Kent peninsula and Bathurst inlet).
2. John Franklin and Geo. Back, The Second Franklin Boat Expedition, 1826, (Mackenzie river west to Return reef, about Long. 149° W., and return).
3. John Richardson and E. N. Kendall, 1826. (Mackenzie delta to Coppermine river and Great Bear lake).
4. Peter Warren Dease and Thomas Simpson, Boat Expedition 1837. (Mackenzie river west to point Barrow and return).
5. Peter Warren Dease and Thomas Simpson, 1838-39. (Coppermine river to about Long. 94° W.)
6. John Richardson and J. Rae, 1848 (Mackenzie river to Coppermine river and Great Bear lake).
7. W. J. S. Pullen and W. H. Hooper, Boat Expedition, 1849. (Point Barrow to Mackenzie delta).
8. W. J. S. Pullen, 1850 (Mackenzie river to cape Bathurst and return).
9. John Rae, 1850-51. (Coppermine river, Coronation gulf and south side of Victoria island).
10. Robt. T. L. McClure, in *Investigator*, 1850-52 (Banks and Victoria islands).
11. Richard Collinson, in the *Enterprise*, 1850-54, (Banks and Victoria islands, Dolphin and Union strait and Coronation gulf, wintered in Camden bay, 1853-54).
    Most of the collections made by the above expeditions are in the British Museum, London.[1]
12. John Ray, John Murdoch, etc., U.S. International Polar Expedition. (Point Barrow, 1881-83).
    Collections in U.S. National Museum, Washington, D.C.
13. Rev. (later Bishop) I. O. Stringer, 1893-1900 (Herschel island to Warren point).
    Collections in the National Herbarium, Victoria Memorial Museum, Ottawa, Ont., and the Museum of the University of Toronto, Ont.
14. Peters and Schrader, 1901. (Colville river and westward to point Barrow).
    Collections in the U.S. National Museum, Washington, D.C.

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[1] See also Amer. Journ. Sci. Arts, Vol. 40, 1841, pp. 9-12.

15. David T. Hanbury and Hubert Darrell, 1902. (Ogden bay to Coppermine river). Collections in Kew Gardens, London.

16. Roald Amundsen, Gjöa Expedition, 1905-06. (Wintered at King point, Y.T., 1905-1906, and passed westward along the coast on the way out). Collections in the Museums of Christiania and Copenhagen.

17. V. Stefansson and R. M. Anderson, 1908-12. (Point Barrow to Victoria island and east of Coppermine river).
Collections in the Museum of New York Botanical Garden, New York.

18. The Canadian Arctic Expedition, 1913-18, (Camden bay to Bathurst inlet and back, including Banks and Victoria islands). .
Main collections in the National Herbarium, Victoria Memorial Museum, Ottawa, Ont. Fairly complete sets in the British Museum and in the Botanical Museum, Copenhagen.

19. Rev. H. Girling, 1915-19. (Mackenzie delta to Coronation gulf and Victoria island).

20. Jos. F. Bernard, 1916-20. (Victoria island and Dolphin and Union strait).
Collections made by Rev. Girling and Capt. Bernard, in the National Herbarium, Victoria Memorial Museum, Ottawa, Ont.

COAST BETWEEN POINT BARROW AND MACKENZIE DELTA

TOPOGRAPHICAL FEATURES

Much information about the topographical features of the coast between point Barrow and Mackenzie delta is scattered in reports and books by and about the various explorers who have travelled there since the days of Beechey, Franklin, and Dease and Simpson. It remained, however, for E. de K. Leffingwell, who spent almost eight years up there, to give the first complete and scientific description of the region, including the mountains north of the divide back of Canning river, treated mainly from a geological point of view, and to present the first accurate general map of the whole coast and more detailed maps of the region west of the international boundary.[1]

The Arctic Mountains

The Arctic mountains, a system formerly considered as an outrunner from the Rocky mountains, stretch as a belt nearly east and west across arctic Alaska at a varying distance from the coast, reaching the sea in the west at cape Lisburne. Their width varies from about 50 to about 150 miles, and at certain places they reach an elevation of 2,000 feet. Their southern contour is very little known, except at Colville river and the international boundary. Towards the east they are continued in mountains of less altitude which end in a scarp along the west branch of Mackenzie river, and to the north they fall off toward the Arctic slope, i.e., the Plateau and the Coastal plain between the mountains and the Arctic ocean. A great number of rivers, a few of which are large, originate on or near the divide and flow northward to the Arctic ocean, generally with a fairly straight course after the mountains have been left behind. In the mountains they commonly flow through glacial troughs.

The Plateau

The Plateau part of the Arctic slope is in general fairly well set off from the mountain base and slopes northward for various distances. It seems to be widest, perhaps about 100 miles, farthest west, though little is known of it except at Colville river where it is 80 miles wide, and decreases in width eastward until it becomes almost entirely absent near the international boundary, where the mountains come closest to the ocean; while, still farther east, it comes near to the sea or even reaches it. It is interesting to note that the Coastal plain, from which as a rule it is divided by a scarp, shows the same characteristics still more pronounced, being more than 150 miles wide at point Barrow and less than 10 miles at the international boundary, and still less farther east.

The Plateau has the form of a rolling, upland tundra, in strong physiographic contrast to the mountains on its south side from which, as stated, it is generally well set off. This upland tundra seems a nearly featureless plain when viewed from an elevation. It is broken here and there by open river or creek valleys trending generally north and south. At certain places, however, the surface is more irregular, due to glacial or fluviatile erosion or deposits, and the ground consists often of rather barren gravel banks or mud cliffs. A good idea of the relation of the Plateau to the mountains may be gleaned from Leffingwell.[2]

The character of the Plateau in the neighbourhood of point Barrow is very little known. Indeed, our knowledge is practically limited to the observations made by Ray[3] on the transition zone between the Plateau and the Coastal plain.

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[1] Leffingwell, E. de K., The Canning River Region, Northern Alaska, U.S.G.S., Professional Paper 109, Washington, 1919.

[2] l. c. Plate XIII.

[3] Ray, P. H. Report of the International Polar Expedition to Point Barrow, Alaska. Washington, 1885, pp. 27-28.

Ray struck across country south of point Barrow for Meade river, which he followed up for some distance until he came within sight of the Meade mountains, and returned practically the same way. Some information about the Plateau east of point Barrow may be gained from Schrader and Peters,[1] who made some observations along the Colville river. A detailed description of the Plateau still farther east, viz., from the Canning River and the Camden Bay regions, is given by Leffingwell[2] who, in his book, also includes observations made by R. M. Anderson in the Endicott mountains at the head of Hulahula river in the fall of 1908, and observations made on sled trips inland from Camden bay by members of the Southern Party of the Canadian Arctic expedition in 1913-14. For information about the Plateau back of Camden bay credit is also due to Collinson.[3]

Concerning the Plateau at the international boundary, reference may be made to Cairnes[4] and to Joint Report, Survey and Demarcation International Boundary between United States and Canada along 141st Meridian, Ottawa and Washington, 1918.

Regarding the character of the Plateau east of the international boundary,[5] information is to be found in Sir John Franklin's[6] account of his ascent of Mt. Conybeare (Buckland chain) in the summer of 1827 and in reports of later explorers who went up Herschel Island river for various distances, viz.: Harrison,[7] Amundsen[8] and O'Neill[9]. It would appear from their reports that, generally speaking, the Plateau comes nearer and nearer the sea from the international boundary eastward to Shealwater bay so that the Coastal plain may be reduced to less than a mile in width or be totally absent, or may be represented only by gravel bars or sand flats. The "coastal plateau" has the form of tundra banks which may reach several hundred feet in height, or rolling hills consisting of mud, sand, or gravel, with steep bluffs where it is subject to erosion by the sea.[10]

Topographically, but perhaps not geologically, Herschel island may be considered to form a part or out-runner of the Plateau, perhaps having become separated from the mainland by a process of erosion by the sea similar to that which is now going on at Kay point, from east and west. The topography and geology of Herschel island are described by O'Neill.[11] The writer has also made a number of observations, but the island is perhaps best treated as a part of the Coastal plain, together with the other islands of the coast.

The Plateau between Stokes point, opposite Herschel island, and the mouth of the Mackenzie delta is little known. A few notes relative to its character are to be found in Franklin,[12] Hooper,[13] Harrison,[14] Russell,[15] and Amundsen.[16]

THE COASTAL PLAIN

General Description

The Coastal plain between point Barrow, about Long. 156°W., and Saganirktok river, about Long. 148°W., is so wide that its southern margin can not be seen from the coast. The upland comes into view from the coast east of the latter river and continues in sight as far as Martin point, about Long. 143°

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[1] Schrader, F. C., and Peters, W. J. A Reconnaissance in Northern Alaska, Professional Paper No. 20, Washington, 1904, pp. 45-46, 81-95.

[2] l. c. pp. 57-58

[3] Collinson, R., Journal of H.M.S. *Enterprise*, etc. 1850-55. London, 1889, p. 313.

[4] Cairnes, D. D., The Yukon-Alaska International Boundary between Porcupine and Yukon River. Memoir 67, Geol. Surv. Canada, Ottawa, 1915, pp 21-25, fig 2 (flora pp 14-18)

[5] See map, Plate XIV

[6] Franklin, J., Narrative of a second expedition to the shores of the Polar Sea. London, 1828, p. 134.

[7] Harrison, A. H., In search of a Polar Continent, 1905-07. London, 1908, p. 63.

[8] Amundsen, R., The North West Passage. New York, 1908, Vol. II, p. 223.

[9] O'Neill, J. J., Summary Report, Geol. Surv. Can., 1914, pp. 112-15.

[10] See Plate VII, fig 1, in Vol. III, Pt K., of these reports.

[11] O'Neill, J. J., Summary Report Geol. Surv. Canada, 1915, p. 236.

[12] l. c. p. 124.

[13] Hooper, W. H., Ten Months Among the Tents of the Tuski, etc. London, 1908, p. 263.

[14] l. c. pp. 72, 74, 76-77, 119-120.

[15] Russell, F. Explorations in the Far North. University of Iowa, 1898, p. 143.

[16] l. c. pp. 137-138.

W. The width of the Coastal plain at Colville river, about Long. 151° W., is 80 miles. It narrows towards the east to near Collinson point, about Long. 145°W., where the upland fronts the sea. East of the Sadlerochit river, about Long. 144·5° W., it abruptly widens to about 50 miles and then narrows where the British mountains approach the ocean at the international boundary line.

From a height only slightly above sea level the Coastal plain rises very gradually to a height of from more than 100 feet to more than 1,000 feet. At certain places, however, for instance east of Collinson point, the rise is much more abrupt and reaches 200 feet within a mile from the coast. Barter island and the area south of it form another exception, the island itself reaching an elevation of 50 feet and presenting a rolling surface.

Locally the dead level of the Coastal plain is broken by large mounds which rise abruptly from the surrounding plain. These mounds usually have the form of rounded domes the altitude of which above the plain reaches a maximum of nearly 300 feet, although most of them are less than 50 feet high. They are especially numerous between the Canning and Colville rivers.

Otherwise the Coastal plain is so featureless that there are many places in which one might become lost without a compass. In all directions there may be simply a flat tundra plain dotted with shallow lakes and ponds. Many of the larger rivers flow through such shallow cuts that their existence might not be suspected at a distance of half a mile. Banks 10 feet high are exceptional, and their maximum height is probably less than 15 feet.

The drainage originating in the plain itself has established very few lines. The surface waters collect into ponds and lakes, and the overflow soaks through the grass to the nearest stream. Some of the larger lakes have definite outlets in the form of widely meandering surface streams which are so narrow that one can step across them. Some of these streams are deep and carry a large flow of water.

The streams have cut gullies near the river banks and the coast but on none of the creeks examined do the gullies run back for more than a mile. West of Colville river, where the plain is much wider, the streams have probably developed high banks. A minor feature of the Coastal plain, yet one that is noteworthy in a region of such slight relief, are low, grassy hummocks, so-called "owl sites,"[1] from one to three feet high, which are scattered sparingly over the flat tundra plain. They have a coating of turf and support a luxuriant growth of vegetation. They were probably formed partly by the lodgment of wind-blown material around driftwood and boulders, perhaps also by fluviatile or morainic deposits. (See Plate I, fig. 1).

In the deltas of the rivers, the banks, particularly the western, are usually covered with silt dunes in belts of various width. Lying off the rivers are mud flats with an extension generally in proportion to the size of the river and to the degree of protection from the waves or currents of the ocean. The land along the whole coast is, as mentioned above, very low, being often invisible from a small boat 2 or 3 miles at sea.[2] Where the tundra banks come to the ocean, and where therefore no gravel or sand intervenes, the erosion of the waves forms the characteristic mud bluffs whose black, loamy muck, often resting on or having imbedded ground ice, shows up as a sharp, thick streak for a long distance. Otherwise the coast line is formed by smaller sand dunes or gravel bars, the bars often enclosing lagoons of varying sizes. As to the formation of the shoals, the reader is referred to McClure[3] and Collinson.[4]

The many islands skirting the coast from point Barrow to Mackenzie delta, with the exception of half a dozen, all consist of the same gravel and sand material as does the coast and often have lagoons. Only Jones islands, Tigvariak island, about Long. 147° W., Flaxman island, Long. 146° W., Konganevik point, Barter island, Manning point, about Long. 143·5° W., and Herschel island consist of higher tundra, their elevation generally increasing eastward from about 15 to above 500 feet. These tundra islands may therefore be considered remains of the mainland coast, formerly reaching farther northward and now cut off by the remorseless action of the waves, which are continuously eating away and undermining the tundra coast while building up at other places numerous sand flats and gravel bars, which in turn become islands.

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[1] These are apparently the same as the "Skua-hummocks" described from Bear Island in Barents Sea by Summerhays and Elton. Journal of Ecology, Vol. XI, 1923, Cambridge, England, p. 223. See also Simpson's Narrative, London, 1843, p. 177.

[2] See also Maguire's Report of the Plover Expedition, p. 34.

[3] McClure, R., The Discovery of the Northwest Passage. London, p. 60.

[4] l. c. p. 363.

It should also be recalled that there has been at least one elevation of the coast line, and perhaps several, in fairly recent times. Boulders, so scarce along the whole coast, are found imbedded in the tundra inland, or at the foot of the mud bluffs where these reach the ocean, for instance at Konganevik and Flaxman island.

Apart from the influence of the waves in forming the coast line, the power of the screwing of the sea ice against the coast occasioned by northeast winds and currents must also be remembered; even if it does not last long and only rarely occurs, it is a very powerful action, as I personally observed in Camden bay at the beginning of July, 1914. (See Plate I, fig. 2).[1]

Most of the mounds on the gravel coast or islands at and east of point Barrow also owe their origin to the pressure or stranding of the sea ice.

The Coastal plain at point Barrow and for a considerable distance eastward is exceedingly low and near the coast scarcely above sea level, the result being that the soil is much saturated with sea water. For a detailed description of it see Ray[2], Dease and Simpson[3], Collinson[4], Hooper[5], Wolfe[6], Schrader and Peters[7], Stefansson[8], and Leffingwell[9].

The coast between Colville river and Camden bay

The geology of this region has been subjected to detailed study by Leffingwell.[10] Concerning Flaxman island, a comprehensive description is also given by Leffingwell.[11] Franklin[12] and Mikkelsen[13] also make some descriptive remarks about the island, the latter calling special attention to the large amount of driftwood from Mackenzie river which lines the beach, while the former was more struck by the thinness of the loose soil stratum, measuring 18 inches, which, underlaid by frozen mud, nevertheless nourishes a good vegetation.

Franklin[14] also mentions a tundra island west of Collinson point which, "like the projecting points of the main shore, is a mere deposit of earthy mud, covered with verdure, about twenty or twenty-five feet high." Leffingwell[15] says that this island has been cut away by the sea in recent times, as well as the adjoining Boulder island.

Konganevik point, about Long. 145°10′ W., is also mostly made up of tundra, as I had opportunity to ascertain during my stay there at the end of June, 1914. Most characteristic is a system of very large lakes along the coast, paralleling the latter in a general east and west direction. These lakes have for the most part tundra bluffs, reaching a height of up to a dozen feet and facing north and south, while low tundra and swamps surround them, connecting them with each other and also with the beach to the east and west, where also their outlets are found.[1] From a distance this low land does not show up at all. Where the beach is low it is represented by gravel and sand, gradually going over into low tundra or swamps which at some places stretch right up to the large lakes described above. (Plate II, fig. 1). Real sand dunes are also found, reaching heights up to ten feet and lying between the beach and the tundra bluffs which slope gradually upwards until they fall off into the bluff slopes on the north sides of the big lakes. Dotted over this "island" part of the peninsula, and especially on low tundra or swamp ground, are many smaller lakes and innumerable ponds, the former with outlets during the snow-melting period.[2] Smaller creeks, which are almost dried up by the end of June, come down to the sea here and there and often form extensive sand bars and lagoons at their mouth.

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[1] See also E. M. Kindle, Amer. Journ. Sci. Vol. VII, 1924, pp. 266-68, figs. 1-2.

[2] l. c. p. 22.

[3] Dease, P. W., and Simpson, Th. An Account of the Recent Discoveries, Journ. Roy. Geogr. Soc., Vol. 8. London, 1838, p. 221.

[4] l. c. p. 144.

[5] Hooper, W. H., Ten Months Among the Tents of the Tuski, etc., London, 1853, p. 229.

[6] Wolfe, H. D., in Report and Population of Alaska at the Eleventh Census: 1890, Washington, 1893, p. 134.

[7] l. c. pp. 47-49.

[8] Stefansson, V., My Life with the Eskimos. New York, 1913, p. 383.

[9] l. c. p. 97 and p. 100.

[10] l. c. pp. 130-242.

[11] Leffingwell, E. de K., Flaxman island, a Glacial Remnant. Journ. of Geol. vol. 16, No. 1. Chicago, 1908, p. 57.

[12] l. c. p. 151.

[13] Mikkelsen, E., Conquering the Arctic Ice. Philadelphia, 1908, p. 98.

[14] l. c. p. 148.

[15] l. c. p. 170.

The coast between Konganevik point and Collinson point has the general character described above, with the difference that there are no very large lakes inland and that a gravel beach mostly intervenes between the sea and the tundra. Near the mouth of Katokturok river the higher tundra comes as rolling hills down to the beach, in much the same way as east of Collinson point. Further east again flat and low tundra sets in in the form of clay plains with sparse vegetation, and with gravel banks along the creeks.

Regarding the immediate surroundings of Collinson point I refer to the detail map made by Chipman and Cox 1913-14, and to Leffingwell's map of Camden bay (Plate XIII). My own observations, from September 1913 to July 1914 inclusive, will be found in connection with the description of the vegetation of the locality.

The coast between Barter island and Herschel island

Martin point and Icy reef, where I made some observations in July and Aug. 1914, are referred to in a following chapter dealing with the vegetation of the region, and concerning the coast around the international boundary I refer to the boundary survey map of 1912. At Demarcation point the Coastal plain shows practically the same features as farther west or east except that it is considerably narrower owing to the proximity of the mountains and to the fact that tundra bluffs front the east side of Demarcation bay for a considerable distance, the coast east of the long sandspit forming Demarcation point.

Herschel Island

Herschel island is about 9 miles east and west by 5 miles north and south, at its broadest. There are three prominent sandspits, viz.: on the southwest, on the south, and on the southeast sides, the latter one forming Pauline cove. Around the whole of the island, rising either from the sandspits or directly from the water, are cliffs of muddy sand, or sandy mud with sometimes considerable black, loamy mud. There is a little gravel in places, but very few boulders and stones. The cliffs range up to 40-50 feet in height, and from the top of them the island slopes upward to a maximum of about 550 feet. The top of the island is rolling and is traversed by broad valleys in the middle of which small creek gorges are sometimes developed.[3] Small lakes and ponds occur, especially in the higher parts of the island, and here and there ground ice is exposed, especially at the slumps which take place during the summer thaw. The island may be considered a raised delta formation, though subfossil shells have been found.

Along the greater part of the north side there is no beach at all, and the high, steep mud cliffs there are constantly eroded both by the sea and by the numerous creeks and temporary freshets which intersect them. The result is a rather forbidding-looking cañon region of black "peaks" with little vegetation. Inland, however, these "peaks" mostly pass into the rolling tundra hills which form the greater and higher part of the island, but even there larger patches are met with on the tops and slopes where the dark, sticky mud or gravel is void of vegetation. This is also characteristic of the clay banks at low elevation. The creeks generally flow in valleys much wider than the amount of water which they contain in the summer time necessitates. They originate in extensive swamps and have sometimes tall willows along their lower courses. On the south side of the east end of the island, the clay bluffs, about 500 feet high, mostly fall off rather sharply to the lower tundra, except where creeks come out and where there are foothills. The tundra in turn passes, through marshes or sandy gravel, into the sandspit at Pauline cove. Taken as a whole, the island is well covered with vegetation which attains a surprising luxuriance and development in low or protected places. (See Plates III-VI.)

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[1] See Plate II, fig. 1, in Vol. IV, Pt. A, and Plate I, fig. 1, in Vol. VII, Pt. N, of these reports.
[2] See Plate V, fig. 2, in Vol. VII, Pt. J, of these reports.
[3] See Plate VII, fig. 2, in Vol. III, Pt. K, of these reports.

The coast between Stokes point and Mackenzie delta

According to O'Neill,[1] the Coastal plain east of the international boundary line rarely exceeds half a mile in width and, generally speaking, decreases in width to the east. Along a considerable part of the coast the waves work directly on the Plateau, and the Coastal plain is missing. Where present, it passes abruptly into the rolling Plateau which slopes gradually upward to a height of about 400 feet and terminates at the north face of the mountains.

The coast line parallels the mountains at a distance of approximately 15 miles, and in the vicinity of the mouths of river[illegible]s of sand and fine gravel have been thrown up, forming long, narrow lagoons along the coast. Boulders are rarely to be seen anywhere. Thus the ocean is held in check near the rivers, but is fast destroying the intervening coast.

CLIMATE

The main records bearing on the climate of the coast between point Barrow and Mackenzie delta are found in the detailed meteorological observations made at point Barrow by the United States International Polar Expedition, 1881-83; in the observations made by Leffingwell and others at Flaxman island, 1906-07, and at other points along the coast, as well as up the rivers inland; and in the observations made by the Southern Party of the Canadian Arctic expedition, especially at Collinson point, 1913-14.

In the following the point Barrow records are not mentioned, as they have already been published and only refer to a limited area which furthermore has been included by Brooks[2] in the treatment of the coast south of point Barrow. The meteorological data secured by the Canadian Arctic expedition, however, are given rather fully, as far as they have any bearing on the development and character of the vegetation, together with references to Leffingwell's observations. It should be pointed out, though, that the remarks on the climate are limited to the Coastal plain proper and that the weather conditions during October to April inclusive, in which months the vegetation is dormant, are treated more summarily.

The first snow in the fall comes between the middle and the end of September, but on occasional, mild days it may melt away again in the sun at noon, so that it is often only from October on that the ground is well covered with snow. The temperatures range on the average from about 25° F. at the beginning of the latter month to about 5° F. at the end of the month; however, from $-10°$F. to $-20°$ F. were recorded October 13-19, 1913, at Collinson point, by the Canadian Arctic expedition. The ground is frozen from the surface down, from the middle or end of September; new ice covers the ponds and lagoons, becoming about a foot thick in the middle of October, and the sea generally freezes over rather suddenly about the middle or end of September. As the month of October advances, the winter begins in earnest, with temperatures around zero; much snow falls and even blizzards occur, though generally the latter are not nearly as bad as during the following four or five months. The weather is often hazy and calm, or rainy and windy. My own observations in the fall of 1913 indicate that the part of the Coastal plain nearest the sea has much more snow, at least during September and October, than the part a little farther back, excepting of course the mountains. While in the beginning of October tufts of grass, willows, the dead fruiting-stems of flowering plants, and patches of soil protruded from the snow everywhere inland, only the higher parts of tall plants were seen above the snow at the coast. The greater part of above-ground plant parts are however dead, though they may remain on all winter, only the inner leaves and buds being green.

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[1] O'Neill, J. J., Summary Report Geol. Surv. Canada, 1914, pp. 62-64.
[2] Brooks, l.c., pp. 146-47, 153-54.

In November and December strong east or west winds are frequent, and much snow comes down covering up the tundra completely. Many tips of long grass leaves and tall plants are however seen protruding from the snow, and the latter is very unevenly distributed, being piled up many feet deep in creek beds and hollows, while on the more level plain procumbent willows and other creeping plants can be seen under a thin snow layer. This uneven distribution is due to sweeping [illegible] which sometimes last several days and attain a velocity of more than fifty [illegible] per hour, [illegible] winds being by far the strongest; they have unobstructed [illegible] over many miles of wide, bare, and flat Coastal plain.

The Canadian Arctic expedition records for November show temperatures ranging from [illegible] above zero to 24°F. below and for December from 3°F. above zero to 4[illegible]. Even in this temperature and at this time of the year there is nevertheless open water here and there in the larger rivers, especially at rapids; or the water flows underneath the ice for a distance to come up through cracks and spread out on top of the ice. The sun sets for the winter about November 2[illegible], but twilight remains.

In January and February the coastal tundra is rather evenly covered with snow which in some places forms hard-blown drifts up to one foot deep, the shape and direction [illegible] are determined by the prevailing winds. Parts of the taller plants such as willows and grasses, however, still protrude from the snow layer or are only partly covered, and the hummocks on the tundra are kept almost free of snow by the violent winds. (Plate I, fig. 1) On the other hand, the snow lies in deep drifts along the tundra-bluffs which face the sea, and in the gulches, or is arrested by the plentiful driftwood lining the beach.[1]

Where mosses and other low-growing plants are exposed to the free air, they are often seen to be [illegible] by a thin layer of ice, while taller plants have icicles hanging from them or are completely enclosed in a coating of ice. This is probably effected by the melting of the surrounding snow on certain days when the rays of the noon sun are especially warm, and by subsequent freezing as may be observed in the fall, from September to October; in fact, most of these ice coatings upon [illegible] may have been formed at that time.

The temperature for January ranges from 29° F. above to 45°F. below zero, and for February from [illegible] F. above to 41°F. below zero, according to observations made by the Canadian Arctic expedition, but temperatures as high as 43·5°F. and as low as −[illegible] F. have been recorded for February by Leffingwell. Snow storms and strong winds, with a velocity up to 62 miles per hour, are frequent both in January and February, but are generally of shorter duration, and accompanied by less cold temperature than in March. During November, December, January, and February, 1913-14, there were 79 days with east winds and 33 days with west winds, on the remaining days the winds were variable.

Even in March the snow is very scarce on the undulating gravel ridges and hills through which the Coastal plain merges into the Plateau inland. There, it is practically restricted to the creeks and typical valleys, where it is many feet deep, levelling the river beds to the surrounding banks and covering to even high willows. Caves are often hollowed out by the wind in this deep, hard-blown snow. In narrow and deep river beds not protected from the prevailing winds, the snow lies as described, but in protected creek valleys or in those which are sufficiently broad to allow free passage for the east to west winds much snow is also seen on the hill slopes, mostly as a uniformly distributed layer, while plants, e.g., grasses and willows, are seen protruding from the snow above and below. The tops of the hills have very little snow, exposed as they are to the full sweep of the winds. Where the surface is very uneven on account of so-called "nigger-heads," the snow correspondingly is unevenly distributed.

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[1] See plate III, fig. 1, in Vol. III, Pt. K, of these reports.

The temperature for March, according to the Canadian Arctic expedition records, ranges from 36°F. above to 46°F. below zero; but temperatures below −50°F. have been recorded by Leffingwell. The month of March has often violent snow storms of long duration and with rather low temperatures, especially in the first half of the month. It should be recorded, however, that there are generally not more than a total of fourteen days with a temperature of −40°F. or below in the four midwinter months, i.e., December to March inclusive.

According to the records of the Canadian Arctic expedition, the temperature at Collinson point ranged from 15°F. above zero to 32°F. below during April. A decided rise of the temperature to above zero takes place at the end or, some years, at the middle, of the month. As in March, snowfalls are frequent, but generally not accompanied by storms and the total amount of snow is probably offset by the almost daily evaporation. Generally speaking the back of the winter may be considered broken at the middle or end of March, the temperature only exceptionally going much below zero from then on.

The last days of April, 1914, the sun had already melted the snow on the south side of the foothills of the mountains, about a dozen miles back of Demarcation point, up to an elevation of several hundred feet. New leaf buds were beginning to appear on the plants there, so that the whole scenery had a far more spring-like appearance than on the north side of the foothills and on the Coastal plain below.

The ground squirrels come forth from their underground dwellings, and the first spring birds appear from the end of April on; but it is first in the middle of May that the great majority of the migratory birds, waders and sea birds, come back.

The temperature at Collinson point for May 1914 ranged from zero to 64° F. above (May 13), but the thermometer went down to −15°F. on May 2nd. The minimum temperature was above 32°F. on only one day (May 4), and on 23 days the maximum temperature was above 32°F. Some snow, mostly wet, falls during the month.

It may be of interest here to refer to some of my field observations about the weather and the appearance of the ground during this month, the records for the first three weeks referring to Demarcation point, and for the last week to Collinson point and the intervening part of the coast.

May 1st was hazy or clear with cold wind; temperature at 2·40 p.m. 0·5°F. Taken as a the whole appearance of the coastal tundra was wintry; the mountains back of Demarcation point also looked very wintry from the distance. The ponds and lakes were covered with a firm layer of snow, and nowhere had the freshwater ice begun to melt, even where the wind had swept it free of snow. There was only a little snow on the whole stretch of the coastal tundra, for the winter winds had taken the snow away from the level ground and deposited it in river and creek beds, bluff-gullies, and among the rough sea ice. Over the whole tundra the dead upper parts of larger plants such as grasses and willows were protruding, and here and there around these plants the melting of the snow had begun and the ground had thawed out a little. But immediately below the surface the earth was frozen and full of ice, and no green, new leaf buds of plants were noticed. On the windswept, gravelly beach, large patches were free of snow, in places where only a thin snow-layer remained during the winter.

The weather the three next days was sunny, with faint wind, and warmer. These few days of fine, warmer weather made more difference in the appearance of the coastal tundra than most of the previous days. Not only was the effect of the sun plainly to be seen on the mountain slopes, which appeared much darker on account of snow-free patches, but the beach also became almost bare, and the tundra-plain too, although to a less extent. The latter began to show its topographical features in detail, and broad patches of snow were only found in low places, while large areas on higher places had no snow at all, or only a few dirty and porous fragments here and there in the minor depressions. The snow-free tundra patches had a distinctly dark-brown colour, owing to the protruding, dead plant parts, but only a few plants, for instance *Cerastium alpinum*, in especially warm places, showed any new, green leaf buds. By digging in the ground and examining the snow-free plants I found the surface of the ground to be thawed out, but half an inch down it was frozen. A thermometer stuck in the dead leaves above the ground showed 32·5°F in the afternoon, a few degrees above the air temperature.

On the 7th of May most of both the smaller and the larger elevations on the tundra were free of snow. But there was still snow lying in the creeks and low places, and also on the larger lake-ponds and coastal lagoons, where none of the ice had yet melted.

The warm, sunny weather the next week melted a considerable amount of the snow on the tundra, and the mountains behind also looked much more bare.[1] But so much snow came down on May 8-9, that in general appearance it was more wintry than during the first week of the month. On May 17th some of the ponds were quite free of snow-ice, others only partly, and many of the tundra plants were showing fresh leaves, stems, and buds.

At the end of May the coastal tundra at Collinson point was almost impassable, having so much soft or melting snow. Here and there were greater, snow-free patches, but the vegetation and insect life, taken as a whole, did not show much sign of spring yet. Even on the last day of May the tundra still looked rather wintry, and though the ponds on it mostly were melted, they had ice at the bottom for long stretches or were partly covered with ice, the latter reaching down to the bottom.

The Canadian Arctic expedition records for June, taken at Collinson point, show the air temperatures ranging from 26°F. to above 70°F. Only on two days, June 25 and 26, did it reach above 60°F., while on twelve days the minimum temperature was below the freezing point.

On June 1, the larger parts of the tundra were free of snow, especially nearest the coast; the overflow from the melted snow-water was assembling in temporary ponds and streams, while patches of snow were lying on the higher parts of the tundra.[2] The hilly upland behind had larger patches of snow only in the creeks and smaller depressions; but the mountains to the south had still more than half of their expanse snow-covered. Most of the dicotyledonous plants were developing new leaves, especially on the parts which during the winter had been covered by snow, for instance in *Cassiope tetragona*, or where they had temporarily been immersed in melt-water during the spring, for instance in Ranunculaceae. The grasses were showing only the dead leaves of the last year so far.

How slowly the ground thaws out was shown by the *Sphagnum* patches here and there on the tundra. The upper two inches of the *Sphagnum* pillows were wet from melted snow and ice but below this they were a part of the completely frozen ground. The *Sphagnum* tops looked nevertheless fresh and green, but by closer examination this was found to be due to many small, round, green algæ, probably deposited by the now evaporated water.

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[1] See Plate III, fig. 2, in Vol. III, Pt. K, of these reports.
[2] See plate IV, in Vol. III, Pt. K, of these reports.

The spring of 1914 seemed to be much delayed on the coast, judging from the plants and insects. This was probably caused by the raw and windy weather from the end of May to the middle of June, which neutralized the effect of the warm, sunny weather in the beginning of May.

From the 8th of June on, the weather became steadily warmer.

At the middle of June most of the snow on the tundra had evaporated or was replaced by melt-water[1]; the shallower ponds were then completely free of ice. Many plants showed new leaves and buds, and the first flowers (*Saxifraga oppositifolia*, *Ranunculus* sp., *Anemone parviflora*, *Salix pulchra*, *S. Richardsonii*, *Eriophorum* sp., etc.) appeared.[2]

In 1914 there was a decided rise of the temperature on June 24th, June 25th and 26th being very hot, as a matter of fact the warmest of the season, with the temperature above 70°F. After that date the mean temperature gradually sank until July. At the end of June the deeper ponds and large lakes still had ice at the bottom, the lakes also showing surface ice in the middle parts.

Records for the month of July 1914 showed temperatures from 32°F. to 58°F. the first day of the month, from 30°F. to 49°F. the next ten days, and from 38°F. to 62°F. the rest of the month, the middle of the month having the highest temperature. The weather was often hazy, with rain or wet snow, owing to the breaking up of the sea ice. All the plants had green leaves and were mostly in bloom.

In the month of August there is generally open water along the coast and for a varying distance out, and there are also open leads in the pack ice farther off shore. Thermograph records for August 18-31, 1913, taken at point Barrow, Alaska, showed temperatures ranging from 18°F. to about 32°F.

During the first three weeks of September the shoal waters of the sea are usually navigable, but new ice may form any time after that. In certain seasons the freeze-up occurs before the middle of the month, in others at the end. As a rule there is ample warning of the close of the navigation. The pools on the land freeze over, and the shoal waters of the ocean may be crusted over several times before the ice becomes permanent. Lagoons and bays without strong circulation of the water generally freeze over before the ocean proper, and open water may remain as extensive leads off-shore or around certain points of the coast for a long time in the fall. While the actual date of the freezing of the sea mainly depends upon the currents in the water, the winds, and the amount of drift ice already present, the lakes, pools, and ponds on land begin to be covered with ice as soon as the temperature sinks below the freezing point.

Thermograph records for September 1-7, 1913, taken when sailing from point Barrow to Collinson point, showed temperatures from 19°F. to 25°F. On Spy island it was noticed, on September 3rd, that the sandspit was already frozen from the surface down, except in places which were covered by snow or washed-up material, and many of the plants were in the fall stage, with dead leaves and stems. Thermograph records for September 8-21, 1913, at Collinson point, showed temperatures ranging from 10°F. to 32°F. On September 20th the ponds on the tundra had ice six inches thick; the ground was frozen from the surface down and the snow which so far had fallen was lying on the low parts of the land, nearest the sea, having melted from the higher ground. Thermograph records for September 22-28, 1913, showed temperatures from 19·5°F. to 31°F. It was a week of surprisingly mild weather. The three last days of the month the temperature gradually got lower, ranging from about 10°F. to 20°F., and much snow fell.

Melt-water is a term brought into use by recent geologists for water derived from melting snow or ice.

For complete observations on the first leaves and flowers, see Vol. III, Pt. K, pp. 7-8.

Concerning soil conditions in general during the growing season reference may be made to Leffingwell[1] who observed:

> "Above the permanently frozen ground there is everywhere a layer which is alternately frozen and thawed each year. The thickness of this layer, though primarily dependent upon the warmth of the sun, is yet so greatly influenced by the nature of the soil that it is quite variable. Porous gravels and sand will thaw many times as deep as muck or clay."

The limit of seasonal thawing is therefore anywhere from a few inches to several feet. The thawing is least pronounced where the ground is covered by vegetation, permanent snow or ice, or where it is sheltered by driftwood, boulders, etc.

To this may be added from Leffingwell[2]:—

> "At present the coastal plain is free from snow scarcely three months in the year. . . . The temperature of the plain adjacent to the Arctic Ocean is kept in the neighbourhood of freezing by the presence of ice-laden waters. Inland the temperature is much higher. . . . Consequently not only would the accumulation of snow be greater near the coast, but the subsequent melting less."

Concerning the climate of Herschel island reference may be made to Preble[3] who gives a summary of the monthly temperatures for the year 1900. According to the monthly mean temperature, the months of 1900 arrange themselves, beginning with the colder ones. as follows: January, February, December, March, November, April, October, May, September, June, August, July. The two extreme monthly mean temperatures for the year in question are −22·6°F. and 42·7°F. with a minimum of −49·4°F. and a maximum of 62·8°F.

VEGETATION

Many of the explorers and travellers visiting the coast between point Barrow and Mackenzie delta have collected samples of the vegetation in different localities, and lists of the plants collected have been published in the accounts of the various expeditions and elsewhere. Nowhere, however, does one find a general description of the vegetation on any part of the coast, and when herewith an attempt is being made to supply such a description, it should be remembered that my personal acquaintance with the coast in summer time is limited to a few localities, and to no locality for a whole season.

In describing the vegetation along the coast between point Barrow and Mackenzie delta the subject will be dealt with under two main headings, viz.: the beach vegetation and the vegetation of the Coastal plain proper. To these will be added a third chapter giving a general account of the vegetation of Herschel island which, as intimated in preceding pages, may topographically be considered an out-runner of the Plateau.

The Beach Vegetation

The beach region includes sand flats, especially at river mouths, and sand spits, gravel bars, etc., on the mainland, together with many islands, mostly small, built up of similar material and stretching along the coast. My observations about the vegetation of the beach region are limited to Spy island, east of Thetis island, Konganevik, Collinson point, and the mouth of the Hulahula river at Camden bay, Martin point, Icy reef and Demarcation point farther east, all west of the international boundary line. Though the typical and dominant plants are the same on the gravel islands and on the mainland, it must be borne in mind that the conditions for the spreading of the more typical tundra plants out upon the beach region are far more favourable on the mainland than on the gravel islands. The vegetation of the latter, therefore, contains few plants, both in number of species and individuals, and will be treated separately.

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[1] The Canning River Region, etc., p. 181.

[2] Journal of Geol., Vol. 16, 1908, pp. 62-63.

[3] Preble, E. A., North American Fauna No. 27, 1908, p. 35.

Gravel and Sand Islands

Spy island. Spy island, about Long. 149°40′ W., is merely a low sand spit with gravel and much driftwood piled up, only a few feet above sea level. There are really 2 or 3 closely connected sand islands forming a semi-circle, the result of the action of waves and ice. The west end is highest and broadest and encloses a lagoon with salt or brackish water which freezes over later than corresponding bodies of water on the mainland coast though it is only about one foot deep, it was completely open on Sept. 3rd, 1913. Apart from the mosses and the variously coloured lichens on the drift wood and the green filamentous algæ filling the lagoon and washed up as a thick and broad layer along its margin, the vegetation is very poor, and I only noticed half a dozen species of flowering plants. They were *Glyceria vilfoidea*, *Stellaria humifusa*, *Halianthus peploides*, the latter in pillows up to one foot in diameter and occurring especially on the higher part of the sand, *Cochlearia groenlandica*, here and there, *Potentilla pulchella*, and *Mertensia maritima*. *Elymus mollis* was not seen.

It will be noticed that these plants are either species typical of dry sandy ground or succulent-leaved species typical of beaches. It is interesting that only half a dozen species have succeeded in establishing themselves from seeds carried over to the desolate island from the mainland to the south and adjacent islands to the east and west. Spy islands may therefore be characterized as extremely barren. Nevertheless, they cannot be of very recent origin—they have been known since 1881—for the vegetation they have is well established, and Leffingwell[1] has shown how extremely slowly the plants spread over such exposed and barren islands.

Martin point. The sandspit islands forming Martin point, about Long. 143°W., have a character quite similar to Spy islands so far as origin and soil are concerned, but their vegetation is far better developed. They consist of sand dunes and gravel bars scarcely above sea level and rising a little higher in the middle where they enclose shallow lagoons, up to half a foot deep, lagoon ponds, and water holes which are almost dried up in the autumn. As on Spy islands, a great amount of driftwood is thrown up along the beach and helps in building up the islands. Except along the lagoons and ponds, the vegetation is rather scattered and occurs mostly in patches and tufts. At the end of July, 1914, I observed and collected the following plants on the small sand dunes rising from the surrounding gravel plain, viz.: *Elymus mollis*, in large patches, *Glyceria tenella*, in pillows, *Salix ovalifolia*, *Stellaria longipes* var. *Edwardsii*, *Cochlearia groenlandica*, *Sedum Rhodiola*, *Potentilla pulchella*, *Artemisia comata*.

Mertensia maritima was found on bare sand near the beach, mostly in colonies of many plants together. Here also was found a mushroom similar to *Agaricus campestris* in appearance.

Plants typical of the gravel plains were *Carex incurva*, with its extensively creeping rhizoms, *Saxifraga decipiens*, and especially *Halianthus peploides*, the latter forming large, scattered pillows up to two feet in diameter and sharply set off from the surroundings.

On mixed gravel and sand were *Papaver nudicaule*, *Polemonium boreale*, *Primula borealis*, *Oxytropis nigrescens*, *Pedicularis capitata*, and *Silene acaulis*, but none of these were present in great numbers.

Both on the gravel and in moist, sandy places, as well as on the small "nigger heads" around the lagoons, *Stellaria humifusa* was common. Around the lagoons *Carex reducta* formed a kind of marsh, while mosses and *Dupontia Fischeri* filled the bottom of some of the dried-up lagoon ponds.

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[1] l.c. p. 171.

The water collections contained many green filamantous algæ, and the usual lichens covered the upper surface of driftwood, stones, etc.

From the above it will be seen that the majority of the plants found are species typical of the beach region, while a few of them are species belonging to the tundra region which have spread over from the mainland nearby – the Martin point islands are only about half as far from the mainland as the Spy islands.

Icy reef. Icy reef, about Long. 142°W., is the most eastern and longest of a chain of sandy gravel islands stretching from point Humphreys in the west to Demarcation bay in the east. While the ocean side is mainly a straight, barren gravel beach, the south side facing the Beaufort lagoon has marshes around its many bights with the vegetation often continued out into Beaufort lagoon. Icy reef is one of the broadest islands on the coast and rises about a dozen feet above sea level. Its gravelly places are more extensive and are composed of bigger stone fragments than are found on most of the other islands. Much driftwood is scattered everywhere and sometimes it fills up the bights on the south side completely. At various places are found lagoon ponds and water holes, mostly dried up in August, and on the higher places are found old Eskimo log shacks, mostly in ruins. Around the latter the plentiful refuse has made the otherwise poor, sandy soil rather fertile and has enabled the vegetation to develop very luxuriantly.

On August 3rd, 1914, I observed the same plants as had been found on the Martin point islands. In addition there were collected, on dry, sandy gravel, *Salix niphoclada*, only one plant; *Alopecurus alpinus*, in patches; *Arctagrostis latifolia*, in more sandy places; *Draba nivalis* and *Saxifraga oppositifolia*, a few scattered plants; *Lychnis apetala; Papaver nudicaule*, many big plants in pillows half a foot in diameter and with flowers up to six inches from the ground, especially around the shacks; *Epilobium latifolium*, etc. In heavy, otherwise completely barren gravel, half a dozen scattered specimens of *Crepis nana* were found, hardly protruding from between the stones. The luxuriant vegetation around the log shacks consisted of *Festuca ovina*, *Poa arctica*, *Saxifraga hieracifolia*, *S. cernua*, *Polemonium boreale*, *Androsace Chamaejasme*, the latter interwoven with grasses.

It will thus be seen that, besides all the plants found on the Martin point islands, Icy reef has a vegetation composed of quite a few additional species, introduced from the mainland tundra.

It is interesting to compare the vegetation of the three islands, or rather groups of islands, described above. Farthest west and north there are the very barren and low Spy islands with only half a dozen species of very scattered flowering plants. Next come the Martin point islands, with about a dozen species of flowering plants in addition, and with the vegetation much better developed generally. Farthest east and south, finally, is Icy reef island, with about a dozen more species than at Martin point, and in places with a very luxuriant vegetation. I ascribe these differences to several factors, viz.: (1), the different distance from the mainland, (2) different latitude, (3) different distance from the Mackenzie river, (4) minor differences in the character of the soil, (5) different extension in east and west of the different islands, (6) difference in the number of visitors, particularly birds and man.

Mainland Beach Vegetation

The beach proper. In describing the vegetation of the beach region of the mainland it should be remembered that my observations at a favourable time of the year, June to August, were limited to the Camden bay region. As, however, this locality is about half way between point Barrow and Mackenzie delta, it may be assumed that the vegetation at Camden bay is of the same general character as along the whole coast, allowing for minor differences caused by some of the factors mentioned in the preceding paragraph. This view is strengthened by my observations on the sand and gravel islands described above, and by the collections of plants formerly made along the coast.

The material forming the beach zone is composed of gravel and sand; the former mainly in shape of bars or spits barely above sea level, going over into the floor of the ocean; the latter either taking part in the formation of the bars and spits, or here and there forming dunes of loose sand which gradually merge into the tundra on the one side and the gravel beach on the other. Where the sand dunes are best developed, for instance at Konganevik, they strongly remind one of certain parts of the west coast of Jutland in Denmark, both as to topography and vegetation. Most of the sand dune plants of the arctic coast have the characteristics described by Warming and others for the sand dune plants of the west coast of Jutland, viz.: unusual development of the rhizoms, and roots and sand-covered parts of the stems running far out in all directions so that the individual plants occupy much more space than when growing on the tundra. The species inhabiting the dunes, such as *Elymus*, *Epilobium*, *Halianthus*, etc., also grow in extensive colonies, to the exclusion of other species, and cover the ground more perfectly than they do on the more barren gravel.

The typical and dominating beach plants are: *Carex stans*, *Elymus mollis*, *Alopecurus alpinus*, *Arctagrostis latifolia*, *Salix ovalifolia* var. *camdensis*, *Stellaria longipes*, *Cerastium alpinum*, *Halianthus peploides*, *Cochlearia groenlandica*, *Epilobium latifolium*, *Polemonium boreale*, *Mertensia maritima* (not found at Konganevik), *Artemisia comata*.

Concerning the vegetation on the extensive flats at the mouths of the larger rivers it would appear, from observations made so far, that on the islands in the river deltas a varying number of non-beach plants spread out from up river and, owing to the quality of the soil, attain a luxurious growth and great expansion. This is especially the case with [illegible]. From a vegetation point of view the river deltas therefore belong n[illegible]erly to the tundra, or even to the inland region, excepting a narrow strip facing the ocean.[1]

The transition zone. The transition zone between the beach and the tundra is very hard to define, both as to topography and to vegetation. It has already been mentioned, and commented upon by all travellers, how very gradual is the rise of the land from the coast inland, and how insignificant the total elevation along the greater part of the coast. This is especially the case where the beach is formed by sand and gravel. It applies, to a less extent, to places where the tundra plain itself is washed by the sea, and still less, of course, to the very few places where the hills come within about a mile of the sea. It is only the very gradual transition zone between the sandy and gravelly beach and the tundra which shows anything interesting in respect to the vegetation; the tundra bluffs facing the ocean have of course neither the beach nor the transition zone vegetation. The transition zone often represents old beach lines, often with partly overgrown driftwood scattered around.[2]

The gravel and sand beach gradually goes over into swamp or a little higher and drier tundra, except where large lakes and water courses intervene. Where there are sand dunes, their inner parts have become so much overgrown that they form a part of the coastal tundra, presenting an undulating zone of hummocks and depressions in front of the often lower, flat tundra; or they have grown together with the tundra bluffs or ridges where these come near the coast.

In the transition zone the vegetation is intermediate in character between the vegetation of the beach and that of the tundra proper. The extent to which the vegetation covers the ground is also intermediate between the dense growth of the tundra and the sparser growth of the beach.

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[1] Cf. plants collected by Schrader and Peters, l.c. pp. 130-34, in the summer of 1901.

[2] See Plate V, fig. 2, in Vol. III, Pt. K, of these reports.

It is rather difficult to assert which plants, besides those of the beach, should be considered characteristic of the transition region. Plants from the tundra apparently get established easily there, often spreading by subterranean rhizoms and thus conquering the ground. As a result quite a few species occur which are really more typical of the tundra. I may, however, give a list of some of the plants which, together with those mentioned as characteristic of the beach, I observed to be more typical and common in the transition region and which often occur in large patches on the gravel plains. They are: *Festuca ovina, Luzula nivalis, Salix pulchra, Oxyria digyna, Lychnis apetala, Papaver nudicaule, Draba alpina, D. fladnizensis, Saxifraga decipiens* var. *groenlandica, S. rivularis, S. Hirculus, S. oppositifolia, Dryas integrifolia, Potentilla pulchella, Astragalus alpinus, Oxytropis nigrescens, Primula borealis, Senecio atropurpureus* var. *subdiscoideus, Taraxacum lyratum,* (Plate II, fig. 2).

From the number of species represented *Saxifraga* may be said to be the most characteristic genus.

THE VEGETATION OF THE COASTAL PLAIN

The Lowland Tundra

In describing the vegetation of the Coastal plain reference may first be made to the low, more or less swampy parts which gradually go over into the beach region. The typical and dominant plants in these grassy swamps are, besides mosses, the following: *Carex rariflora, C. rigida, C. reducta, C. stans,* with *C. subspathacea* populating the marshes at creek outlets, *Eriophorum angustifolium, E. Scheuchzeri, Alopecurus alpinus, Hierochloe pauciflora, Salix reticulata, S. Richardsonii, Polygonum Bistorta, Oxyria digyna, Stellaria humifusa, Lychnis apetala, Ranunculus sulphureus* (more common on dry tundra),*Cardamine pratensis, Saxifraga cernua, S. hieraciifolia, Rubus Chamaemorus, Empetrum nigrum, Senecio palustris.*

In the swamps are often lakes and ponds in and around which, besides *Carex* and *Eriophorum*, are found *Cardamine pratensis* and *Pedicularis sudetica.* Typical, more or less immersed species are: *Equisetum variegatum, Caltha palustris, Ranunculus Pallasii, Hippuris vulgaris* var. *maritima.*

Carex is the most characteristic genus for the tundra swamps and *Hippuris* the most characteristic one for the ponds.

Instead of by swamps the coastal tundra is often represented by a little higher and drier plains, inland gradually rising as small ridges which fall off to creeks, rivers, or lakes as bluffs formed in more remote times, or to the sea where they are undercut and washed away in the summer time by the waves. The vegetation on these drier tundra plains is very dense and exceedingly uniform in all directions for many miles. The soil is sometimes more sandy, and sometimes more gravelly, or composed of clay, and the ground ice may reach to within a few feet of the surface. The great amount of vegetation, however, mostly produces a muck soil rich in humus, brown in colour, and made fertile by the decaying plants. The vegetation is not quite as dense as in the swamps, where no bare spots are to be seen, but it is richer and more close than on the bluffs, ridges, or slopes, and in the beds of the water courses, where patches with scattered vegetation or none at all are often met with. The typical and dominant plants on the low and more dry coastal tundra are, as follows: *Equisetum arvense, Lycopodium Selago, Arctagrostis latifolia, Alopecurus alpinus, Festuca ovina* var. *brevifolia, Luzula nivalis, L. spicata, Lloydia serotina, Salix pulchra, S. Richardsonii, S. rotundifolia, S. reticulata, Betula glandulosa, Oxyria digyna, Silene acaulis, Alsine arctica, Ranunculus nivalis, R. sulphureus, Papaver nudicaule, Cochlearia groenlandica, Draba alpina, D. fladnizensis, Eutrema Edwardsii, Saxifraga tricuspidata, S. Nelsoniana, S. hieraciifolia, S. decipiens* var. *groenlandica, S. oppositifolia, S. Hirculus, Dryas integrifolia, Potentilla pulchella, Rubus Chamaemorus, Lupinus nootkatensis, Phaca frigida, Oxytropis nigrescens,* *Empetrum nigrum*, *Pyrola grandiflora*, *Ledum palustre*, *Cassiope tetragon* *Vaccinium caespitosum*, *Primula borealis*, *Polemonium boreale*, *Pedicularis lanat* *P. capitata*, *Lagotis glauca* var. *Stelleri*, *Artemisia comata*, *Senecio atropurpure* var. *subdiscoideus*, *Saussurea angustifolia*. (Plate III, fig. 1, and Plate I, fig.

The absence of *Carex* is noticeable.

It has been mentioned that the vegetation on the ridges and bluffs and i the river beds is a little different from that of the surrounding lower tundr Certain plant species seem to prefer such localities and are found in great numbers there, even if the vegetation is otherwise rather scanty. Similarl certain plants seem to prefer the minor elevations or so-called "owl sites" on t low tundra. The vegetation on these is in general unusually luxuriant, perhap owing to the fertilizing influence of the various animals which frequent them.

The following plants I observed as common and characteristic for t higher tundra ridges and the bluffs back of Camden bay, viz.: *Equisetum arvens* *Lycopodium Selago*, various grasses, *Lloydia serotina*, *Salix pulchra*, *S. rotundifolia*, *Betula glandulosa*, *Oxyria digyna*, *Silene acaulis*, *Papaver nudicaule*, *Dry integrifolia*, *Potentilla emarginata*, *Lupinus nootkatensis*, *Phaca frigida*, *Oxytrop nigrescens*, *Cassiope tetragona*, *Primula borealis*, *Pedicularis arctica*, *Lagot glauca* var. *Stelleri*, *Petasites frigida*.

Among the plants on the rather barren clay and gravel banks in and alon the river beds near the coast at Camden bay the following are the most don inating, viz.: *Salix pulchra*, *Oxyria digyna*, *Silene acaulis*, *Papaver nudicaul* *Parrya macrocarpa*, *Potentilla emarginata*, *Oxytropis nigrescens*.

As mentioned above, the small hummocks or so-called "owl sites" on th coastal tundra plain have generally a luxuriant vegetation. There is, howe no marked difference between the character and composition of the plants and of those covering and forming the tussocks or so-called "nigger heads which are so typical and common a feature of the tundra especially at a littl distance from the coast. The plants noticed on the "owl sites" at Camde bay, besides lichens and mosses, were as follows: *Carex misandra*, *Luzula spicat* *Salix pulchra*, *S. rotundifolia*, *Cerastium alpinum*, *Stellaria humifusa*, *Ranunculu nivalis*, *Draba alpina*, *Saxifraga tricuspidata*, *S. bronchialis*, *Dryas integrifolia* *Potentilla nivea*, *Pyrola grandiflora*, *Ledum palustre*, *Vaccinium caespitosum*.

The Upland Tundra

Sadlerochit river.[1] The general character of the vegetation on the slope and tops of the rolling hills along the Sadlerochit river back of Camden bay is th same as on the Coastal plain nearer the sea. Besides lichens and mosses, th dominating plants are species belonging to the families of Gramineæ, Cyperace Salicaceæ, Caryophyllaceæ, Saxifragaceæ, Cruciferæ, Rosaceæ, Papilionace Ericaceæ, Scrophulariaceæ, and Compositæ. *Epilobium latifolium* and *Artemisi* sp. are typical plants on the sand flats and gravel bars in the river beds while *Juncus Haenkii*, *Carex stans*, and *C. compacta* occur in inundated places On the higher "islands" and on the lower part of the adjoining slopes there is luxuriant and typical tundra vegetation with *Betula glandulosa*, *Polygonu Bistorta*, *Empetrum nigrum*, *Pyrola grandiflora*, *Ledum palustre*, *Vacciniu Vitis-idaea* var. *pumilum*, *Saussurea angustifolia*, and many others, while *Sali Richardsonii* attains more than arm thickness and man height. Higher up o the slopes large patches of *Alopecurus alpinus*, *Arctagrostis latifolia*, *Anemon Drummondii*, *Papaver nudicaule*, *Saxifraga decipiens* var. *groenlandica*, *Androsac Chamaejasme*, and *Aster sibiricus* grow in sandy places, while *Ranunculus* sp. *Saxifraga Nelsoniana*, *Cassiope tetragona*, *Pedicularis* sp., and *Petasites frigid* prefer more moist localities. The tops of the hills have a more scarce vegetation, with *Silene acaulis*, *Saxifraga tricuspidata*, *S. oppositifolia*, *Dryas octopetala*, *D. integrifolia*, *Potentilla* sp., and *Rhododendron lapponicum* as the most typical and common flowering plants. Besides lichens and mosses, *Alsine arctica*, *Saxifraga tricuspidata*, and *S. flagellaris* are typical plants growing on the cliff sides exposed here and there along the river and its tributaries.

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[1] Observations made in Nov. 1913.

Collinson point. The upland at Collinson point, according to observations made in March and June, 1914, is composed of gravel hills and ridges of a very uniform appearance intersected by creeks, inland going over into level plains forming a table-land with sharply marked creek valleys, and stretching back to the Plateau. West of Collinson point, through undulating ridges of gravel or tundra bluffs, it goes gradually over into the low coastal part of the plain. Generally speaking, the vegetation, apart from the many lichens on loose stones, is much more scarce on the upland than at the coast. It attains its best development in the bottom and on the slopes of the creek valleys, with Gramineæ, Cyperaceæ, and Salicaceæ predominating. A typical and common plant, which is less frequently met with at the coast, is *Cassiope tetragona*. It occurs especially between the "nigger heads" of the tundra and in depressions on more gravelly soil where the spring moisture is retained. Where the transition zone between the more barren upland and the coastal region is composed of tundra, the latter often contains many "nigger heads," and on and between them the vegetation, with *Lupinus*, *Eriophorum*, *Saxifraga*, etc., often attains a still more luxuriant growth than nearer the sea.

East of Collinson point the tundra upland comes very close to the sea in the form of rolling gravel hills with broad creek valleys. The latter often have extensive swamps near the mouth, and the vegetation, represented by Gramineæ, Cyperaceæ, *Salix Richardsonii*, *Ranunculus* sp., etc., attains a great development. Farther inland the valley goes over into tundra slopes with "nigger heads" and a rich vegetation. These slopes merge gradually into hills composed of stony clay, sand, or gravel, which mostly are without any vegetation to speak of except in the creek beds and here and there on south-facing slopes. Typical plants on these more barren bluffs of clay or sand are *Saxifraga tricuspidata* and *Anemone parviflora*, the former growing in sharply defined "bunches," the latter in small patches among grass in more protected pockets where the ground is damp.

Konganevik. Typical plants on the tundra bluffs facing the large lakes inland at Konganevik are *Lloydia serotina*, *Primula borealis*, *Pedicularis hirsuta*, and *P. arctica*, the two first ones growing in clusters especially in protected places, the two last ones more scattered. *Lycopodium Selago*, *Silene acaulis*, *Saxifraga oppositifolia*, *Dryas integrifolia*, and *Cassiope tetragona* are also very common and typical plants on the bluffs inland.

There is often a considerable difference in the development of the vegetation on the north and south sides of the bluffs, the former being much the poorest, except in well protected pockets. Owing to the less open character of the country, the vegetation on the upland seems to develop a little earlier in the season than nearer the coast.

HERSCHEL ISLAND

The vegetation of Herschel island is unusually luxuriant, considering the latitude, except for barren patches found here and there. Judging from the information available, the vegetation of the coastal plateau on the mainland opposite, Stokes' point and eastward, is of a similar character and is represented by the same species of plants, so enthusiastically commented upon by the various travellers who have been there during the height of the summer.[1] In the following I shall, however, limit myself to a description of the vegetation of the east end of Herschel island where I made botantical collections for two weeks in July and August, 1914 and 1916.

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[1] Cfr. Collections made at King point by the Gjöa expedition (Ostenfeld, C., Vascular Plants collected in Arctic North America by the Gjöa Expedition 1904-1906. Vid. Selsk. Skr. I. Mathem.-Naturv. Klasse, 1909, No. 8, Christiania, 1910), and at Shingle point by J. R. Cox and J. J. O'Neill (J. M. Macoun and Theo. Holm, Report of the Canadian Arctic Expedition, Vol. V, Botany, Part A: Vascular Plants, Ottawa, 1921.)

The village at Pauline cove is situated on the sandy or gravelly shore around the bay, formed by a broad, curved, low tongue of land running out from the hills to the east and west. *Mertensia maritima* is a typical plant for the beach. Near or at the water front a slight relief is produced by sand dunes, refuse heaps, etc., and especially the latter ones quickly become overgrown with vegetation. Typical and common plants are *Elymus mollis*, *Sisymbrium sophioides*, *Potentilla rubricaulis*, *Bupleurum americanum* (often in large patches), *Polemonium caeruleum* var. *villosum*, *Matricaria inodora* var. *grandiflora*, *Achillea borealis*, *Artemisia vulgaris* var. *Tilesii*, *A. comata*, *Senecio frigidus*, etc., together with certain other plants which perhaps more properly belong to the vegetation more inland, for instance *Aconitum delphiniifolium*, *Castilleja pallida*, and *Myosotis silvatica*.

The more or less swampy tundra which intervenes between the gravelly beach region and the dry clay ground at the foot of the hills behind has the following typical plants, viz.: *Equisetum arvense*, *Carex stans*, *Eriophorum Scheuchzeri*, *Salix pulchra*, *S. reticulata*, *S. Richardsonii*, *Polygonum viviparum*, *Rumex arcticus*, *Ranunculus affinis*, *Saxifraga Hirculus*, *S. Nelsoniana*, *Pedicularis sudetica*, *Lagotis glauca* var. *Stelleri*, *Valeriana capitata*, all seemingly preferring moist ground.

On the higher, dry clay ground at the foot of the hills, a variety of plants are found which, however, cover the ground far less perfectly than is the case on the swamp so that many bare patches show up.[1] Besides a few grasses, e.g., *Poa arctica*, the typical plants are: *Luzula hyperborea*, *Alsine arctica*, interwoven with *Cassiope tetragona*, *Papaver nudicaule*, *Draba hirta*, *Eutrema Edwardsii*, *Hesperis Pallasii*, *Parrya macrocarpa*, *Saxifraga hieraciifolia*, *Astragalus alpinus*, *Phaca frigida*, *Oxytropis campestris* var. *sordida*, *Hedysarum Mackenzii*, *H. alpinum*, *Arctostaphylos alpina*, *Castilleja pallida*, *Artemisia comata*, *Petasites frigida*, *Senecio resedifolia*, *Taraxacum ceratophorum*.

On the exposed, dry clay slopes the following are in addition common and typical, viz.: *Carex incurva*, *Silene acaulis*, *Delphinium scopulorum* var. *glaucum*, *Saxifraga tricuspidata*, *Sieversia glacialis*, *Bupleurum americanum*, *Selinum cnidiifolium*, *Primula stricta*, *Gentiana arctophila*, *Polemonium caeruleum* var. *villosum*, *Myosotis silvatica*, *Pedicularis verticillata*, *P. capitata*, *Erigeron uniflorus*. *Aconitum delphiniifolium* and *Caltha palustris* forma *radicans* also occur but are less typical and common. (Plate III, fig. 2)

It is in the protected bottoms however, and on the sides of the creeks, where a rich and moist clay soil exists, that one finds the greatest number of flowering plants. They attain there an unusual development. Besides various Cyperaceæ, e.g. *Carex* and *Eriophorum*, Gramineæ, e.g. *Poa arctica* and *Trisetum spicatum*, and willows, e.g. *Salix Richardsonii* and *S. pulchra*, the following are typical and common, viz.: *Lloydia serotina*, *Rumex arcticus*, *Oxyria digyna*, *Lychnis affinis*, *Stellaria longipes* var. *Edwardsii*, *Anemone parviflora*, *Ranunculus affinis*, *Eutrema Edwardsii*, *Parrya macrocarpa*, *Sisymbrium sophioides*, *Parnassia Kotzebuei*, *Saxifraga cernua*, *S. radiata*, *S. tricuspidata*, *Dryas integrifolia*, *Potentilla rubricaulis*, *Lupinus nootkatensis*, *Phaca frigida*, *Dodecatheon frigidum*, *Androsace Chamaejasme*, *Gentiana arctophila*, *Polemonium caeruleum* var. *villosum*, *Myosotis silvatica*, *Castilleja pallida*, *Pedicularis capitata*, *Lagotis glauca* var. *Stelleri*, *Valeriana capitata*, *Achillea borealis*, *Matricaria inodora* var. *grandiflora*, *Artemisia comata*, *Petasites frigida*, *Senecio palustris*, *Saussurea angustifolia*. (Plates III-VI).

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[1] This characteristic growth, so common at many places inland in the American Arctic region, especially west of Mackenzie river, may perhaps be ascribed mainly to the disturbing of the soil by melt-water, both from snow and from ground ice, and the thus occasioned slumps. I imagine, therefore, that the vegetation, occurring in scattered tufts and patches with bare ground between, represents both what remains of a former, more perfect plant covering, and plants spreading by seed from undisturbed places to the "new" ground available when the disturbance is over. The latter seems particularly to apply to *Silene acaulis*. (Cfr. John Muir, The Cruise of the *Corwin*, New York, 1917, Appendix pp. 271-72).

The grassy swamps which form the origin of the creeks inland at the "divide" have, where the ground is less wet, as their most typical plants Gramineæ and Cyperaceæ, *Salix reticulata, Aconitum delphinifolium, Cardamine pratensis, Saxifraga cernua, Valeriana capitata*, besides many of the plants mentioned in the preceding paragraph. On the parts of the swamps which surround eventual ponds are found, in addition, *Dupontia Fischeri, Stellaria longipes* var. *Edwardsii, Chrysosplenium alternifolium* var. *tetrandrum, Potentilla palustris*, and *Vaccinium Vitis-idaea*, all but the grass interwoven with moss, etc., while the ponds themselves have a rich vegetation with *Arctophila effusa, Eriophorum Scheuchzeri, Carex, Caltha palustris* forma *radicans, Ranunculus Purshii, Hippuris vulgaris* var. *maritima*, and *Sphagnum fuscum* as the dominant plants.[1]

On the top of the hills, say above 300 feet, most of the plants found on dry clay ground at the foot of the hills occur, the soil being of the same character. Extensive bare patches are met with; the grasses are more dominant than at a less elevation, and a very uniform, typical dry-ground trundra vegetation occurs. It is composed of lichens, mosses, willows, *Dryas, Cassiope*, and other very hardy plants less common below, while certain other plants, for instance *Betula glandulosa, Empetrum nigrum, Ledum palustre, Vaccinium caespitosum*, are exclusively found up here or mainly so, among the latter being also *Polygonum Bistorta*. On the other hand, certain of the plants from the lowland, e.g. *Cerastium, Aconitum, Papaver, Saxifraga, Sieversia, Lupinus, Polemonium, Petasites*, etc., may occur at surprisingly high altitudes and are found on isolated hummocks where the latter are sheltered by small clay bluffs.

Taken as a whole, the vegetation on Herschel island is uniform from the beach to the hill tops, and the types of vegetation, which have been briefly outlined, generally intergrade.

The following plants have been collected by Rev. I. O. Stringer[2] on Herschel island but not observed by myself, viz.: *Halianthus peploides, Lychnis apetala, Delphinium scopulorum* var. *glaucum, Anemone Richardsonii, Ranunculus hyperboreus, R. occidentalis* var. *robustus, Draba alpina, D. nivalis, Potentilla nivea, P. Vahliana, Oxytropis nigrescens, Hedysarum alpinum* var. *americanum, Primula borealis, Aster sibiricus*.

The following, collected by the Gjöa expedition[3] on Herschel island, were observed there neither by Rev. Stringer nor by myself, viz.: *Poa pratensis, Glyceria distans, Festuca rubra* var. *arenaria, Carex rupestris, Salix arctica?, Thlaspi alpestre* var. *purpurascens, Cochlearia officinalis* var. *groenlandica, Astragalus eucosmus, Oxytropis Roaldi, Polemonium boreale, Pedicularis arctica, Arnica alpina, Senecio lugens, Taraxacum eurylepium*.

Concerning the vegetation of the part of Mackenzie delta lying north of the woods, I refer to Vol. III, Pt. K., p. 16, and to the plants collected by Rev. Isaac O. Stringer as recorded in Vol. V, Pt. A.

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[1] See Plate II, fig. 2, in Vol. IV, Pt. A, and Plate I, fig. 2, in vol. VII, Pt. N., of these reports.
[2] J. M. Macoun and Theo. Holm, l. c.
[3] C. Ostenfeld, l. c.

COAST BETWEEN MACKENZIE DELTA AND BATHURST INLET

CAPE BATHURST

The Cape Bathurst peninsula has on its east side slaty and mostly steep clif the famous "smoking mountains." It is, however, that part of the peninsu which faces the two Baillie islands which principally interests us. Both Bail islands and the mainland coast present tundra bluffs underlaid in places ground ice and large blocks of the latter may be seen standing like immen boulders at the beach, washed out by the sea and covered with a layer of mu I did not visit Baillie islands myself, but they are known to be below 10 fe high and have the character of typical tundra islands with sandspits and lagoon

A long spit of gravel and sand juts out towards the northwest from t mainland peninsula, and the village and harbour of cape Bathurst are situat at its end. At the latter place is a grassy spot with a lagoon pond, but the ston which make up the shingle composing the spit have no growth of lichens them, proving that in stormy weather and at very high tide the sea reaches over the spit. This is further emphasized by the appearance of the place whe the sandspit joins the tundra behind; a belt of tumbled-down tundra sods an barren muck washed out by the sea is found there while the bluffs themselv are steeply cut and intersected by gullies, perhaps mainly made by drainag water in the spring. The gullies gradually merge into swampy depressio between the higher parts of the tundra. Still farther up, these gully swamp contain more water and branch out where brook tributaries come down; bac of it all is finally the typical, higher tundra with its swamps, ponds, lakes, grav hummocks, etc., stretching far inland.

My own observations from this place are limited to an afternoon, Ju 26th, 1916, but in the following description of the vegetation I have includ what I have gathered together from other sources.[1]

The gravelly sandspit is barren of vegetation apart from a few, typica beach plants near the village. These comprise three grasses, viz.: *Alopecuru alpinus, Glyceria vaginata, G. vilfoidea,* the last two growing in the swamp place at the above mentioned lagoon; also *Halianthus peploides, Cochleari groenlandica,* and *Mertensia maritima,* The absence of some of the most typica beach plants, e.g. *Elymus mollis,* is interesting, the reason probably being tha the sandspit got its vegetation in fairly recent times. Unfortunately, howeve those who have collected plants at cape Bathurst from the time it was discovere by Richardson and Kendall in 1826 have not distinguished between the vegeta tion on the sandspit and that of the tundra behind, or the collections wer perhaps only made on the latter.

The water holes in the swampy part of the gullies at the time of my visi were almost filled with algae, mosses (*Drepanocladus Wilsoni*), and the equall submerged *Ranunculus Purshii,* while *Carex stans, Eriopherum angustifolium E. Scheuchzeri, Caltha palustris* forma *radicans, Cardamine pratensis, C. digitat Chrysosplenium alternifolium* var. *tetrandrum,* and other typical swamp plant were growing in or around them. On the little drier parts of the swamps a fe of the more typical tundra plants had entered in addition, viz.: *Saxifraga cernua S. Hirculus, Pedicularis sudetica,* etc. At the places where the swamps merge into the higher tundra behind were found the plants common on the latte though only a few of them were in bloom, viz.: mosses, lichens, fungi, grass *Lychnis apetala, Dryas integrifolia, Potentilla Vahliana, Pedicularis arctica Senecio palustris,* etc.

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[1] P. A. Rydberg, in V. Stefansson, My Life with the Eskimos, New York, 1913, pp. 447-48. Collection made by Dr. R M. Anderson.

A number of plants common on the dry ground were found on top of the tundra bluffs and on the slopes of the intersecting gullies facing the above mentioned gravel spit. The dominant plant there was the interesting *Phlox Richardsonii*, in full bloom, and growing in large, spreading pillows up to one foot in diameter, on the edge of the niggerheads. On all the *Phlox* plants the innermost leaves were dead and, where much exposed, there were many dead branches; where growing more protected, they showed a rather luxurious growth. The other plants on the bluff tops and slopes were various grasses, viz.: *Poa arctica*, *Alopecurus alpinus*, *Agropyrum alaskanum*; also *Luzula spicata*, *Salix anglorum* (growth prostrate and spreading, but the twigs and female catkins protruding well from the grass; plants with dropped, male catkins), *Oxyria digyna*, *Cerastium alpinum*, *Stellaria longipes* var. *Edwardsii*, *Ranunculus nivalis*, *Papaver nudicaule*, *Cochlearia groenlandica*, *Draba alpina*, *D. nivalis*, *Eutrema Edwardsii*, *Potentilla pulchella*, *P. Vahliana*, *Primula borealis*, *Androsace Chamaejasme*, *Erigeron uniflorus*, *Taraxacum lyratum*, etc., almost all plants typical of dry hills and slopes. It was interesting to observe that, while the *Phlox* was not found in the more moist and sandy bottoms of the gullies, the small-flowered *Ranunculus Sabinii* was almost limited to them and very typical there.

COAST SOUTH OF AMUNDSEN GULF

A general description of the western part of this coast has been furnished me by Dr. R. M. Anderson, as follows:

> "The land along the western shores of Franklin bay gradually rises to the southward of cape Bathurst, from low earth banks around cape Bathurst to high bluffs beginning to the northwest of Trail point ("Whale bluff") where shale, sandstone, etc., form high sea-cliffs. The sea-cliffs are practically continuous for thirty-five or forty miles, being broken only by gaps formed by a few insignificant creeks, and the broad gap where the Horton river breaks through. At irregular intervals for about thirty miles, extending on both sides of Horton river, carbonaceous shales are smouldering underground, sending up clouds of steam and smoke, so that this stretch of coast bears the name of Smoking mountains. The name of mountains is not very appropriate as they are merely comparatively level-topped sea-cliffs, rarely over 200 or 300 feet in height, and sloping quite regularly away to the westward. A few miles south of Horton river the steep hill slopes are usually about half a mile or so back from the sea and the ground slopes down to the sea in low gravelly or sand terraces, which are grassed over, with a few ponds or marshy spots. Towards Langton bay the hills become higher and swing two or three miles back from the coast, forming the Melville mountains which are about 1,000 feet high south of Langton bay and run about east and west south of the Parry peninsula and Darnley bay, merging into the somewhat irregular high lands east of cape Lyon and south of Amundsen gulf. With the exception of a few higher points which have been dignified by the name of mount Hood, mount Davy, etc., the range becomes lower towards Dolphin and Union strait, at least near the coast, although the land in general rises quite rapidly towards the southward, being in general rather dry, stony and sterile like the land around Bernard harbour.
>
> "South of Langton bay, the Melville mountains have a rather abrupt slope to the northward or seaward side, and slope gradually landward, a broad rolling upland descending somewhat towards Horton river. Horton river flows in a rather narrow and deep valley sparsely fringed with trees along its banks for about fifteen or twenty miles to the northwestward of Langton bay. Some creeks flowing into Horton river

> south and west of Langton bay have small spruce running a mile or tw up their valleys.
>
> "The country as a whole is rather barren in some places, stony in other or sandy, cut up by gullies into a sort of "Bad lands" formation.
>
> "The northern half of the Cape Parry peninsula is mostly a yellowis rock formation, like much of the coast of southern Victoria island, an along the south side of Amundsen gulf, but much cut up by deep an narrow fjords.[1] The backbone of the peninsula is a high ridge runnin close to the west side of Darnley bay; the lower, or southern half of th peninsula being mostly low land interspersed with numerous small lake often connected with narrow, winding channels. This low land is we covered with grasses and tundra mosses."

From cape Lyon to the vicinity of Clifton point the coast is made u largely of diabase and dolomite cliffs. Farther east the dolomite occurs bot along the coast and inland, until the southern part of Coronation gulf is reache

The following plants were collected at Clifton point by Mr. D. Jenness an the late Rev. H. Girling, viz.: *Elymus mollis*, *Anemone parviflora*, *Papave nudicaule*, *Draba alpina*, *Saxifraga oppositifolia*, *S. tricuspidata*, *Potentill emarginata*, *Oxytropis campestris* var. *sordida*, *O. arctobia*, *Androsace Chama jasme*, *Phlox Richardsonii*, *Mertensia Drummondii*, *Pedicularis lanata*, *Erigero compositus*, *Artemisia* sp., *Taraxacum ceratophorum*. No other observation or collections of plants were made between cape Bathurst and Young point b the Canadian Arctic expedition

After the Southern Party of the Canadian Arctic expedition sailed fron winter quarters at Bernard harbour, we were stopped by the ice for severa days near Young point, which gave me an opportunity to make some observations and to collect plants, etc., there. The coast is exceedingly stony, with dolomite outcrops, or low cliffs with much debris and gravel. Nearest the beach there is no vegetation at all and farther back it is limited to lichens and mosses on the debris or in holes between the stones and is best developed in moist places. Here and there, especially in shelter of boulders, are a few tufts of *Dryas integrifolia* and *Saxifraga tricuspidata*. Farther inland the vegetation gets a little better, especially in depressions where ponds are situated and on the swampy tundra surrounding or connecting these. Plants typical of gravelly dry ground and rocks predominate and, though the same species as at Bernard harbour occur, the vegetation is decidedly poorer than at the latter place. Only of grasses, carices, salices and three *Saxifraga* species, viz.: *S. oppositifolia*, *S. tricuspidata*, *S. decipiens* var. *groenlandica*, did I find rather big pillows; the other plants were often represented only by a single specimen or a few small ones. The small fern *Cystopteris fragilis* was a typical plant growing in moist places, in cracks in the dolomite rocks or on debris, between pieces of which the compressed rhizomes of the plant were squeezed in in a most striking manner. On drier ground *Saxifraga cernua* grew between stones in the same manner as this fern. Both plants were rather common, though occurring in limited numbers.

The following plants were collected there, viz.: *Cystopteris fragilis*, *Hierochloe pauciflora*, *Alopecurus alpinus*, *Arctagrostis latifolia*, *Eriophorum Scheuchzeri*, *Carex rigida*, *Luzula* sp., *Salix anglorum*, *S. reticulata*, *Silene acaulis*, *Lychnis apetala*, *Stellaria longipes* var. *Edwardsii*, *Cerastium alpinum*, *Alsine* sp., *Papaver nudicaule*, *Draba alpina*, *Eutrema Edwardsii*, *Saxifraga cernua*, *S. Hirculus*, *S. decipiens* var. *groenlandica*, *S. tricuspidata*, *Dryas integrifolia*, *Pedicularis sudetica*, *Chrysanthemum integrifolium*, *Senecio palustris* var. *congestus*

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[1] See Plate VIII, fig. 1, in Vol. III, Pt. K, of these reports

BERNARD HARBOUR

CLIMATE

In October the winter may be said to begin in earnest, though the temperature during the first week of the month generally is not lower than the freezing point (1914-15). As the month advances the temperature keeps steadily below 32°F., but above zero, only exceptionally going below the latter point at the end of the month. The highest temperature for October was recorded at the beginning of the month, 1914, with 41°F., and the lowest at the end of the month, 1915, with −13°F. The weather is mostly overcast, sometimes with snow and fog, though regular snowstorms are rare. The new ice forms on the sea at the beginning or middle of the month, and its gradual increase in thickness has a steadying influence on the temperature and keeps the latter down. Southern winds generally raise the temperature a little, but otherwise the direction of the wind has little influence on it. A comparison of the weather in October 1914 and 1915 shows that the temperature was generally lower and that the winter came earlier the latter year. This difference affected plant life in the beginning of the month; in 1914 it held out longer than in 1915.

A comparison of the weather in November 1914 and 1915 shows that the two months were rather similar, apart from more stormy weather in 1914 than in 1915 and milder temperature in the beginning of the month in 1914 than in 1915, though the last days of the month were milder in 1915 than in 1914. The records also show a decided drop in the temperature, to zero and below, after the first week of the month. The highest temperature recorded was 23°F., at the beginning of November, 1914, and the lowest was −27°F., at the end of November, 1914, and in the third week of the month, 1915.

The temperature in December was generally lower in 1915 than in 1914, but the winds were considerably stronger in 1914. The highest temperature, 26°F., was recorded in the second week of December, 1914, and the lowest, −37°F., in the third week of the month [illegible]15.

The month of January, 1915, w[illegible]ably colder and calmer and had more clear days and more snowfal[illegible]ame month, 1916, though in the latter year the drift was more f[illegible] stronger. The differences between January 1915 and January 191[illegible]ticularly striking from the second week on. In 1915 all the maximum te[illegible]atures were below zero from the second week on, whereas in 1916 they all w[illegible] above during the same period. The lowest temperature, −46°F., was recorded in the end of January, 1915, and the highest, 12°F., in the second week of the month, 1916.

A comparison of the weather during February, 1915, with that of February, 1916, shows that the beginning of the month was much stormier and less cold in 1916. On the other hand, during the rest of the month the temperature was generally considerably lower in 1916, the minimum for the winter of 1915-16 being reached then, almost a month later than in the winter of 1914-15. The highest temperature, 5°F., was recorded in the second week of February, 1915, and in the first week of February, 1916, the lowest, −43°F., in the third week of February, 1916.

In the month of March there was a marked rise in the temperature from the middle of the month on, with maximum temperatures above zero both in 1915 and 1916. In 1915, the temperature went lower and the weather was less stormy and more clear than in 1916. The lowest temperature, −42°F., was recorded in the first week of March, 1915, and the highest, 29°F., in the third week of the month the same year.

In April, both 1915 and 1916, there was a gradual rise in the temperature with occasional, unexpectedly warm days, generally in the latter half of the month. On the other hand, there were also occasional days with rather wintry weather. The predominance of easterly winds was very characteristic, and the winds were not as strong as during the winter. April 1916 had on the whole considerably warmer weather than April 1915; this of course influenced the awakening of the plant life, which came earlier than in 1915. The lowest temperature, 23°F., was recorded in the middle of April, 1915, and the highest, 50°F., in the third week of April, 1916.

In the month of May shorter periods of cold weather may be encountered, and quite a little snow may fall, but it soon melts, and the melting of the snow may be said to progress continuously as the month advances. It was observed that, at the end of the month in 1916, the season was as advanced as at the middle of June in 1915. Minimum and maximum temperatures in 1915 were registered on May 2nd and 22nd respectively, the minimum being −1·9°F. and the maximum 62°F. In 1916, the minimum temperature for the month was observed on May 2nd, with 7·7°F.,, and the maximum on May 8th, with 75·2°F.

In order to illustrate the climatic conditions during the month of May, the following observations, made during 1915 and 1916, are given. The first four days of May, 1915, the country, as seen from a high vantage point, still looked wintry and had much snow. On closer inspection, however, the snow was seen to disappear from gravelly places where the strong wind during the winter had allowed only little snow to remain. This was especially the case with a few of the gravelly bluffs and the south-exposed parts of slopes and ridges at the harbour. Where bare gravel was exposed, the ground was thawed about half an inch down. The snow melted rapidly in the day time, particularly on May 3-4, and became soft and wet, with many bare places showing; the temperature rose to 41·6°F. Colder weather prevailed, however, the next four days, and a snow storm lasting for three days covered up the bare places on the ground. Apart from two colder days in the middle of the month, when the thermometer did not rise above 35°F., the temperature the following two weeks was milder, May 22 being unusually warm with the temperature rising to 62°F. The melting of the snow was progressing rapidly, so that large areas, particularly on the tops of ridges and on slopes with a southern exposure, became bare, and the ground thawed out to a depth of one inch from the surface. Temporary pools both on the sea ice and on land appeared on May 22.[1] Two days later the ridge west of the harbour was mostly free of snow, excepting the south side and in swamps and ponds higher up. At noon the thermometer showed a temperature of about 45°F. in the air. In dry gravel, melted free of ice several days before, it registered 46°F., and in plant tufts on the same snow-free stretch, 36°F. The last week of May the weather was overcast and windy but, with the temperature between 22°F. and 53°F., the snow remained wet.

In 1916, the snow began to melt the last days of April but strong snow drift, lasting for three days in the beginning of May, covered up all the bare places, and the maximum temperature remained below freezing (about 20°F.) until May 6. The two next days, however, were warmer, and on May 8 the temperature rose to 75°F. As a consequence, the snow melted rapidly and mosses, etc., thawed out in their upper layers. The next day, however, was much colder, the temperature dropping to 28°F., and though the two following days were warmer, with a maximum temperature of 45°F., the middle of the month was colder, and quite a little snow fell and covered the places melted bare about a week before. The week of May 19-26 was surprisingly warm with maximum temperatures ranging from 47°F. to 62°F. The weather was clear, and the snow melted at a rapid rate so that finally all higher places with sand, gravel, and tundra, with the exception of slopes, became bare, and much stagnant and running melt-water was to be seen. On May 21 the following observations were made at the harbour: air at noon 43°F.; thermometer lying in a water accumulation of melted snow, with dark bottom, on the tundra, showed 51°F.; in snow-free, dry plant tufts, the thermometer registered 51°F.; in drier, bare, gravelly sand, 57°F.; and when placed in a snow-free, dry sand dune, 58°F. (the last record taken at 2 p.m.). On the five last days of the month the maximum temperatures were not quite so high, ranging from 36° F. to 47°F., but the melting of the snow continued at a quick rate, aided by the eroding action of the now open creeks and smaller streams, resulting in the land becoming practically free of snow.

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[1] See Plate IX, fig. 1, in Vol. III, Pt. K, of these reports.

In the month of June, 1915, the minimum temperature did not rise above freezing until the 20th, it being then 32·7°F. As a result the vegetation was very backward. The first flowers of *Saxifraga oppositifolia* were observed on June 9th, but as late as the 15th they were found with frostbitten petals. Still later in the month damage from frost was observed on *Elymus mollis* which, on June 24th, was noticed to have partly frostbitten leaves. Flower buds were observed on *Oxyria digyna* the last days of the month. The minimum temperature for the month was 19·5°F., on June 6th, and the maximum 50·8°F. on June 23rd. In 1916, the weather was cold and windy every day through the first half of the month. The development of the vegetation was consequently delayed, and it was not until the middle of the month that flowers of the early *Saxifraga oppositifolia* became common. The minimum temperature for the month was 28°F., on June 5th, and the maximum 76°F., on June 22nd.

The ups and downs in the weather even in June are well illustrated by the following observations. The first week of June, 1915, had maximum temperatures between 36°F. and 53°F., but strong winds and drifting snow retarded the development of the vegetation. On an excursion inland from the harbour it was observed that there was much snow on the ground everywhere; it had melted a little only on the ridges and the smaller hummocks, but less so than nearer the sea. None of the ponds and lakes showed any melting yet. The mid-day sun made the first flowers of the year open up on June 9, when the temperature rose to 47°F., but subsequent colder and windy weather lasting to the middle of the month, with maximum temperatures between 36°F., and 45°F., and with occasional rain or a little snow, much retarded the coming of summer. It was noticed, however, that especially on the extensive mud flats at the bottom of the bays south of the harbour there was much melt-water in the shape of temporary pools and ponds. The surrounding smaller sand dunes were quite free of snow, but the sand was still wet. On the other hand, there had hardly been any definite progress in the melting of the snow inland since the beginning of the month, except in more elevated places; the moss tufts were as yet thawed only about one inch down. On June 17-18 the large creek at the harbour had become quite a stream of melt-water, running out over the bay ice and devouring it, and helped by the brooks coming down the surrounding slopes. The peninsula where the house of the expedition was built was now mostly free of snow, the latter remaining only in depressions and at the foot of the slopes. On the sandy, snow-free slopes on the south side of the peninsula the ground which was free of vegetation was thawed up to 12 cm. down, only the surface being dry. Thermometer stuck into the sand showed, at 2.30 p.m. a temperature of 67°F., when protected from the wind, otherwise 38°F. The maximum temperatures of June 16-24, inclusive, were all between 43°F. and 51° F., and June 21-23, particularly, were real summer days. The last six days of June, however, had maximum temperatures from 39°F. to 44°F., with mostly overcast and unsettled weather. On June 28 some observations were made inland, west of the harbour. The land there was practically free of snow, which remained only at the foot of slopes and in depressions. All the ponds and lakes, with the exception of the three biggest ones, were completely ice-free and had reached their maximum extension. The shallow lake feeding the creek was open in the west, where the outlet is, and otherwise its ice was in an advanced stage of melting, with water on top and many loose cakes. The creek itself was quite open and had reached its maximum in water content and swiftness; the temperature of the water at its margin was 35°F., with the air 38°F. at noon. The temperature of the water in grassy bights at the shore of the lake was 51°F., and a pond near the lake had a temperature of 46°F., with the air 39°F. (at 5 p.m.).

In 1916, the maximum temperatures for the first half of June were all between 30°F. and 48°F., but the weather was mostly overcast, with occasional rain and colder than the corresponding period in 1915. The reverse was however the case in the latter half of the month; owing to predominant easterly or southerly winds the weather was warmer in 1916 than in 1915. Thus the maximum temperatures for June 17-21 were between 49°F. and 65°F., and on June 22, the next warmest day of the year, the thermometer even rose to 76°F. Apart from an occasional shower the weather continued clear the last week of the month, with maximum temperatures between 55°F. and 59°F.

In the month of July, 1915, the minimum temperature rose to 40°F. or above only on four days; the maximum temperature rose to 55°F. or above on eight days. The minimum temperature for the month was registered on July 30th, with 30·5°F., and the maximum on July 23rd, with 75·5°F. In the first week of the month flower buds were observed on *Epilobium latifolium* and *Salix reticulata*, and on the 12th *Elymus mollis* began to head out.

The first half of July, 1915, had minimum temperatures ranging between 32°F. and 47°F., while the maximum temperatures for the first eleven days were between 43°F. and 56°F. During the latter period the weather was mostly clear, with occasional fog or rain. July 12-14 were very warm, the maximum temperatures being 74-75°F., with clear or overcast weather, so that all the land around Bernard harbour became free of snow and the large lakes free of ice.[1] Particularly the smaller ponds were beginning to dry up through evaporation. The maximum temperatures for July 15-22 were between 46°F. and 65°F., the last day being the warmest, with mostly overcast and windy weather and with occasional showers. July 23 was the warmest day of the whole summer (75·5°F.), but the last week of the month the maximum temperature dropped to between 36° F. and 60°F.; the weather was mostly rainy or windy. The minimum temperatures for the last half of the month were between 30°F. and 48°F.

For July, 1916, observations are available for only the first two weeks. The maximum temperatures for the first week were between 48°F. and 62°F., and for the second week between 60°F. and 77°F., July 7-9 having the warmest weather recorded for the summer, the maximum temperatures ranging from 72°F. to 77°F. The weather was mostly clear and calm, but some days windy and with occasional showers. Owing to the prevalence of easterly and southerly winds the weather during the first half of July, 1916, was warmer than the corresponding period, 1915.

Observations on the weather in the month of August, 1915, show that the minimum temperature rose to 40°F. only on one day and that it dropped as low as 28·4°F., the latter being registered on the last day of the month. The maximum temperature reached 56°F. or more on four days, the highest temperature being reached on August 18th with 68·3°F. In the first week of the month 1915 many of the shallower ponds were dried up, and the large creek contained so little water that its mouth had no connection with the sea. Water was only found in it as pools here and there at deeper places or as streams intersecting the gravel bed and *Carex* swamps. The lakes became quite free of ice during the month, and the smaller ones much reduced in size by evaporation.

In August, 1915, the vegetation was so well established in its summer stage that the daily differences in the weather had little influence unless the minimum temperature fell below freezing, which happened the ten last days of the month. About half of the days of the month were clear and the other half overcast with light winds. Rain or fog prevailed on ten days during the first three weeks, and Aug. 21 had intermittent snow.

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[1] See Plate IX, fig. 2, in Vol. III, Pt. K, and Plate IV, fig. 1, in Vol. VII, Pt. E, of these reports

It will thus be seen that July and August are the only months of the year practically without any snowfall. The months in question, however, have quite a little rain or fog. This is a direct result of the breaking up of the sea ice and of occasional incursions of drift ice and is of decided importance to the development of certain types of vegetation, such as fungi, lichens, and mosses, which are more dependent upon the atmospheric humidity than upon that contained in the ground.

In September, 1914, about half of the days were clear and the rest overcast, with fog, rain, or wet snow almost every second day. September 19, 23, and 27 had more wintry weather with snow, and when on September 29 much drift ice assembled in the outer harbour, which had been free of ice for about three weeks, the weather immediately became thick and snowy.

In September, 1915, the minimum temperature fell below freezing on not less than twenty-four days, the lowest being reached on Sept. 21 with 13·6°F. The maximum temperature of the month was recorded on Sept. 6, with 44·3°F. The lowest maximum temperature, 28°F., was recorded Sept. 18 and 21, and on four other days in the middle of the month it was below freezing. There was only a total of about a week of clear weather, particularly at the end of the month when there were 3-4 days of real "Indian summer" with the snow melting on the ground. Rain or wet snow fell in the beginning and at the end of the month on about a total of six days, with more foggy weather, while the middle of the month had real winter.

A conspicuous difference between the weather in Sept. 1914 and the same month in 1915 was noticed. In 1914, the rather mild weather prevailing most days of the month allowed the plants to keep their flowers and ripen their seed far into the month; the more winterly weather was neither too severe nor of sufficiently long duration to quell the plant life until October. Snow fell in the latter half of the month but mostly melted again and the freshwater accumulations froze over first at the end of the month. In 1915, however, stormy and wintry weather came on suddenly the second week of September and lasted for about a fortnight. The result was immediate and lasting freezing of the freshwater bodies and the ground and the quelling of the plant life. The snowfall was also heavier and covered the ground earlier and more completely than in 1914.

TOPOGRAPHY AND VEGETATION

Generally speaking, the coast gets gradually lower from cape Bexley to east of Bernard harbour, and the outcrops of limestone or dolomite are first found some distance inland. At Cockburn point especially, the coast is low and flat and composed of gravel, limestone fragments and boulders, the latter mainly on the smaller points jutting out here and there, separating the bights and lagoons. Back from the coast the country is quite similar to that at Bernard harbour, as described in following pages, with boulder-strewn ridges of sand and gravel running out from the higher land behind.[1]

Pihumalerksiak Island

This small island is situated about a mile off Cockburn point and about eight miles northwest of Bernard harbour. Its height is about a dozen feet above sea level, and it is composed of limestone-dolomite which crops out as flat beds on the north side of the island. Otherwise the rock is mostly covered by gravel and vegetation, with many boulders and rock fragments scattered everywhere.

In depressions here and there are smaller ponds, which probably dry up in August, and mossy bogs. Besides in these places, the vegetation is principally found around the boulders and stone heaps built by visiting Eskimos for meat caches. Around the latter the plants often attain a luxuriant and extensive growth and the often big tussocks are used by eider ducks as nesting plac Otherwise only patches and tufts of plants are found here and there and, generally speaking, the vegetation is rather scarce and stinted, except in the shelte of groups of rock or in similar situations (Plate X, fig. 1).

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[1] See Vol. XII, Pt. A, p. 15, of these reports.

On July 15, 1916, a number of plants were collected. The few shallow water-hole ponds still holding water were almost filled with the submerge *Ranunculus hyperboreus*, mosses, and green algae. The mossy bogs representing former water-holes had a scattered growth of *Cantharellus muscigenu* and *Ulothrix tenerrima* on top of the moss cover, with *Senecio palustris*, at th time of my visit in beginning bloom, as a typical plant among the moss (Plat X, fig. 2.)

Besides lichens and mosses, by far the commonest plants on the island were *Glyceria vilfoidea*, *Poa hispidula*, and *Potentilla pulchella*, together with th common beach plants *Stellaria humifusa*, *Cochlearia groenlandica*, and *Saxifraga rivularis*. Less common were patches of *Alopecurus alpinus* and *Salix anglorum*. Of the latter generally several prostate individuals were growing together; they were not nearly so spreading as on the mainland. *Cerastium alpinum*, a *Draba* sp., and *Saxifraga decipiens* var. *groenlandica* also occurred; of *Silene acaulis*, *Papaver nudicaule*, and *Dryas integrifolia* only a few specimens were found.

It was interesting to note the absence of certain plants, e.g., *Anenome*, *Pedicularis*, Leguminosae, etc., common on the mainland nearby; this is probably due to the exposed situation of the island and to the small amount of good soil on it.

Islands in the outer harbour at Bernard harbour

The islands in the outer harbour are composed of gravel, sand and boulders, and vary in size and character from the low boulder reef without any vegetation at all, not even lichens, situated at the entrance to the outer harbour, to the larger and higher island at the entrance to the inner harbour which may be considered a continuation of the mainland points north and south of it.

Of the three smaller islands between the west point of Chantry island and the mainland opposite I examined most closely the largest and most eastern one, the so-called Uloqsaq island. It is composed entirely of gravel and rock debris with many boulders along its higher part and on the steeper south side A few temporary pools formed of melt-water, the largest of which is on the flat west end, are found on the island; they are quite dry in July. On the higher half of the island lichens are common on the stones but otherwise the vegeta is very poor. Except on the beach, where *Elymus mollis*, *Stellaria* sp *Halianthus peploides*, *Mertensia maritima*, etc., grow, plants occur only around water-pool depressions where especially *Salix anglorum* is characteristic, and in shelter of the bigger boulders on the highest parts of the island where in certain places are found grasses, *Carex* species, *Stellaria longipes*, *Silene acaulis*, *Papaver nudicaule*, *Draba* sp., *Saxifraga oppositifolia*, *S. tricuspidata*, *Potentilla* sp., etc. It was observed that a number of plants, such as *Dryas integrifolia* *Androsace Chamaejasme*, etc., which are common on the mainland and on Chantry island, do not occur on this smaller island.

The gravel island off the mouth of the fishing creek east of the harbour ha no rock exposures either, though it has several boulders. The vegetation i very poor. Apart from the lichens on the stones on the higher part of the islan [illegible] is found as patches here and there along the beach, consisting of *Elymus mollis*, *Carex* sp. (*subspathacea*?) and *Stellaria* sp. Around the big boulders these three species attain their greatest development and occur as large pillows A grass, a *Draba*, and a *Potentilla* species are also found, together with lichen and mosses. A number of plants common on the mainland are not found on th island.

The island at the entrance to the inner harbour is separated by a narrow tortuous channel up to 12 feet deep from the point of the mainland south of it and by a wider channel less than 3 feet deep from the point of the mainland north of it. Especially along the west side of the island limestone beds crop out nearly at the surface of the water. They are almost dry at low tide and fall off steeply to the deeper water of the middle of the inner harbour. On the island proper, which is about 25 feet high, no outcrops of bedrock are to be seen; it is composed of limestone and other rock fragments, with many boulders scattered over it or assembled at certain places. Generally speaking, the north side of the island has the rock debris quite to the sea, with gravel patches here and there, while the south and west sides have gravelly slopes and a beach. On the west side the beach is sandy. Owing to the nature of the soil and to the exposed situation of the island, the vegetation is very poor when compared to that of the mainland about a hundred yards away. Over large areas there is nothing but lichens on the stones and a few, scattered pillows of grass, *Alsine verna* var. *rubella*, *Silene acaulis*, *Papaver nudicaule*, *Saxifraga oppositifolia*. In depressions and in the shelter of big boulders a few additional plants are found, viz.: *Salix anglorum*, *Cerastium alpinum*, *Saxifraga tricuspidata*, *Dryas integrifolia*, *Potentilla* sp., *Oxytropis* sp., *Artemisia* sp., which sometimes form extensive pillows. On the gravelly west side the vegetation is best developed, especially near the sandy beach where there is most protection from the prevailing northeast winds. Besides the plants mentioned above, I noticed there *Elymus mollis*, *Lychnis apetala*, *Stellaria longipes* var. *Edwardsii*, *Cochlearia groenlandica*, *Saxifraga rivularis*, *Androsace Chamaejasme*, *Erigeron compositus*. There is also a fair vegetation in the swampy depressions which surround the temporary collections of melt-water in the middle and higher part of the island. There I found, in addition to the plants mentioned above, *Glyceria* sp. *Festuca rubra* var. *arenaria*, *Carex* sp., *Oxyria digyna*, *Pedicularis lanata*.

Chantry island

Chantry island is about 85 feet high. It consists of dolomite, mostly covered by fragments, gravel, and vegetation, but cropping out in the higher part of the middle of the island and on the south side. The higher parts on the north and west sides of the island are rather barren, except for lichens on the rocks, and the vegetation occurs mainly in depressions and in the shelter of large boulders. The east and south sides of the island, however, have a rather good vegetation. Beside the dozen or more ponds scattered over the island, there are many temporary melt-water collections, which are dry in July, occupying depressions on the terraces from the beach up to the highest parts of the island. As the ponds dry out in the course of the summer, extensive swamps appear around them or take their place (Plate XII).

My observations on the island in the summer season are limited to a day in the middle of June, 1916, when *Salix anglorum* and *Saxifraga oppositifolia* were the only plants in bloom. I collected all the different plants I saw, but the time at my disposal was too short for a detailed examination of the vegetation on this large island. Generally speaking, however, the vegetation is very similar to that of the mainland, though some more inland species, for instance *Salix pulchra*, *Rhododendron lapponicum*, *Arnica alpina*, seem to be missing. The following flowering-plants were collected, viz.: *Poa* sp., *Elymus mollis*, *Carex pulla*, *C. misandra*, *Salix anglorum*, *Silene acaulis*, *Lychnis apetala*, *Cerastium alpinum*, *Stellaria* sp., *Draba* spp., *Saxifraga oppositifolia*, *S. tricuspidata*, *Dryas integrifolia*, *Potentilla* spp., *Astragalus* sp., *Oxytropis* spp., *Statice Armeria* forma *sibirica*, *Pedicularis lanata*, *P. capitata*, *Artemisia* sp.

Mainland at Bernard Harbour

Topography. From an unexplored "hinterland," higher land consisting of boulder-strewn hills of sand and gravel, with dolomite bedrock cropping out here and there, comes down to the coast in the shape of generally continuous ridges. These contain lakes and ponds and consist of the same material as t land behind, but have a larger amount of boulders and dolomite fragments, a terminate in stony points or reefs at the sea shore. In a few cases the ridges a not connected with the high land behind but are separated from it by low la with lakes and ponds. Particularly where the dolomite crops out inland flat, low beds covered with debris and with ponds in the depressions, a kind table land occurs which usually, however, has a very limited extent. Betwe the ridges are valleys which often are extensive and here and there have pon and larger lakes. They are often bordered by small bluffs of gravel or tund and come out to the sea at the heads of bays. The mouth of the valley general contains a smaller creek, and presents a gently sloping tundra swamp going ov into sand dunes that are sometimes conspicuous, or into gravel plains which turn merge into the sandy beach.[1]

One gets perhaps the best idea of the variety of the ground in the vicini of Bernard harbour by following the large fishing creek, Nulahugyuk cree from inland down to the sea. Inland it runs sometimes through stony an barren ground, at other places through stony and sandy tundra, or throu swamps with a rich vegetation; again for a stretch it cuts through the out-croppi bedrock. Its bed therefore contains many boulders, grassy bogs, or sma islands of sand; or it has a floor of smooth rock, according to the nature of th surrounding ground. Particularly in its lower part, it is divided into channe or has bights or pools, quite apart from the artificial stone weirs constructed f salmon fishing by the Eskimos; in its lower part it also cuts through grav ridges.

The two lakes inland at Bernard harbour have already been described The most southerly lies mostly deep down among the surrounding tundra bluf or higher gravel ridges. Its east side is formed by a gravelly shore which go over into tundra.[3] Nearer the large creek the latter forms a slope with swamps surrounding the course formed by melt-water draining off during the earl summer. The elevation of the lake is about 65 feet above the sea. At it northwest end a partial outlet is formed by ponds and tundra swamps whic eventually unite into a short but wide creek which has its mouth in a broad bigh of the other large lake in the valley. The upper part of the creek is deeper an has a muddy bottom; it runs through a grassy and swampy valley bordered b gravel ridges. The lower part is shallow and has a stony bed, and cuts throug the gravelly or clayey higher tundra surrounding the large, shallow lake which feeds.

This lake is situated at an elevation of about 25 feet above sea level. lies in an extensive valley and is practically surrounded by low tundra swamps forming shallow bights or small inlets with abrupt mossy brinks along th shore. On the south side, where the above mentioned creek comes out, and a some distance from the present shore of the lake, the low, swampy tundra i replaced by drier, higher tundra composed of "nigger heads" or more stony o clayey soil; it goes over into gravel slopes farther away. There are some outcrops of dolomite back of the south side of the lake where tributary stream come down from the slopes. The whole lake is exceedingly shallow, less tha three feet deep, with a few large protruding boulders and with a stony botto except in its deepest part, while the other large lake mentioned above is up t 15 feet deep.

Vegetation. In describing the vegetation, it must be explained that mor or less definite zones like those found west of the Mackenzie delta do not exist on the mainland at Bernard harbour. Under the circumstances an account will be given of the various, more or less intergrading types of vegetation which are found under different edaphic conditions, without any attempt to arrange them in distinct botanical zones. For the sake of clarity, however, the vegetation will be described under two headings, viz., Coastal Area and Inland Area.

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[1] See Vol. XII, Pt A, p 16, of these reports.

Report of the Canadian Arctic Expedition, Vol. VII, Part N., Ottawa, 1923

See Plate III, fig. 1, in Vol VII, Pt. N, of these reports.

Coastal Area

The beach region in the area in question everywhere consists of marine sand or gravel. The characteristics of the beach vegetation, the very limited number of certain xerophytic plants which inhabit it, and their scattered growth are well known from other places in the northern hemisphere and have already been given in this report so far as the arctic coast west of Mackenzie delta is concerned. As I found no beach plants at Bernard harbour which did not also occur along the coast farther west and as, generally speaking, the beach regions, as far as the vegetation is concerned, is far less developed, both as to width and littoral extension, at Bernard harbour than along the coast west of Mackenzie delta, it is not necessary to treat it in much detail.

As mentioned above, the soil composing the beach is either of a sandy or of a gravelly nature. The places where sand solely occurs are indicated on Chipman's and Cox's map (Plate XII) by stippled lines at the head of the bays cutting in between the points formed by the gravel ridges and at the mouth of the large fishing creek east of the harbour. Such places, which may properly be termed sand flats, are more or less inundated by melt-water in the spring. They are practically devoid of vegetation, except for a scattered, sparse growth here and there of *Carex*, *Juncus*, etc., which follow the course of the larger creeks out to where the fresh water mingles with the sea water.[1]

A more distinct and much more extensive part of the beach region, however, is made up of the sand dunes at the bottom of bays, and of the gravel fringing the coast everywhere else. The sand dunes are not nearly as well developed as at Camden bay, clayey or gravelly stretches intervening or replacing them along most of the coast. *Elymus mollis* is the most characteristic and dominant plant upon the sand dunes, but it also grows on the sandy stretches of gravel outside the dunes. The same is the case with *Alopecurus alpinus* and *Trisetum spicatum*, *Halianthus peploides*, and *Carex stans*, and to a less extent with *Stellaria humifusa*. *Polemonium* and *Epilobium latifolium* do not occur on the sand dunes, probably owing to the less development of the dunes. On the other hand the minute *Pleurogyne carinthiaca* with its unusually large flowers was found only on the sandy ground near the beach at Bernard harbour. The large and much spreading *Salix ovalifolia* var. *camdensis*, so characteristic of the sand dunes in Camden bay, was not found at Bernard harbour. The two most typical beach plants at Bernard harbour are *Mertensia maritima* (rather rare) and *Cochlearia groenlandica*, both being practically limited to the gravelly or sandy, level beach, though *Cochlearia* is also a characteristic plant, together with *Carex subspathacea* and *Stellaria humifusa*, around lagoons and brackish ponds. The species of *Artemisia* occurring at Bernard harbour, viz.: *A. Richardsoniana* and *A. hyperborea*, are not limited to or particularly characteristic of the coastal sand dunes, though the greatest number of them may occur on dunes back from the coast where they and *Elymus mollis* sometimes compose practically the whole vegetation. *Statice Armeria* forma *sibirica* is generally considered a typical plant of beaches and salt-marshes and occurs as such also at Bernard harbour, mainly on gravel. Near the beach the individual plants are however both small and rather few, while farther inland, particularly upon the drier tundra swamps, the plant is more common and grows to a much larger size. A number of other plants often spread to the beach from their true home beyond it, but cannot be considered typical components of the beach vegetation.

It has been emphasized, in the description of the vegetation along the Alaskan Arctic coast, how difficult it is to differentiate between the beach and the coast region farther back, except through the lack of the most typical beach plants in the latter region; and this holds good also for a description of tl vegetation at Bernard harbour. On the other hand it has also been mentione in the preceding paragraph, that certain beach plants, viz.: *Elymus* and *Statio* typical of sandy places and gravelly beaches respectively, are found farther bac from the shore where suitable places are available. The most typical plants the transition region between the beach and the coast beyond it are perhaps tl following, viz.: *Alopecurus alpinus*, *Calamagrostis purpurascens*, *Poa arctic* *Festuca ovina* var. *brevifolia*, *Elymus mollis*, *Carex* spp., *Salix anglorum*, *Stellar* *longipes* var. *Edwardsii*, *Cerastium alpinum*, *Draba* spp., *Sisymbrium sophioid* (only on certain hummocks), *Saxifraga tricuspidata*, *Dryas integrifolia*, *Potentil* spp., *Astragalus alpinus*, *Oxytropis* spp., *Androsace Chamaejasme*, *Gentian* *propinqua*, *Plantago lanceolata*, *Erigeron compositus*, *Artemisia* spp., *Taraxacu* sp. (Plates VII-IX)

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[1] See Plate V, fig. 1, in Vol. VII, Pt. J, of these reports.

The best represented family is Gramineae, and one of its members, *Al* *pecurus alpinus*, may be considered the most typical plant of the transitio region. It is almost exclusively limited to it and occurs particularly on sand ground, where it generally grows in large patches. The same may perhaps l said of the more obscure *Stellaria longipes* var. *Edwardsii*, which grows more single plants, while *Salix anglorum* is easily the most conspicuous of them al owing to its large size and far-spreading growth. (Plate VII, fig. 2). Th other plants, except *Gentiana* and *Sisymbrium*, are just as common on drie sandy or gravelly ground at a greater distance from the beach.

In proceeding to describe the vegetation inside the beach region a few word may first be said about the vegetation in and around the lakes and ponds.

In the first place, true lagoons or lagoon ponds, so characteristic a featur of the Alaskan Arctic coast, are not found at Bernard harbour, except perhap some miles northwest of it on the low coast around Cockburn point, though eve there the beach is much more stony than sandy. Apart from the big, dee lake[1] near the beach just south of the station, and the partly formed lagoons a the outlets of the creek in the bays south of it, there is only one other body o water of marine origin at Bernard harbour, namely the small brackish pon situated south of the creek outlet west of the station. This pond has alread been described in another report[2] and it is therefore sufficient to say, in thi connection, that it contains no other vegetation than green algae and the minut *Carex subspathacea*, the latter mainly as a dense growth, excluding other plant and forming the marsh around the pond.

The plants occurring in the many ponds and lakes at Bernard harbour ar the same as those described from the coast farther west. Apart from algae mosses, and typical, submerged plants such as *Batrachium confervoides* an *Hippuris vulgaris* var. *maritima*, the vegetation in the water is mainly made u of plants spreading out into it from the surrounding tundra swamp, thoug certain species, for instance *Equisetum variegatum*, certain species of grasses an *Carex*, *Eriophorum angustifolium*, *E. Scheuchzeri*, *Cardamine pratensis*, seen to thrive best when partially submerged and are not found any distance from th water.[3] The genus *Juncus* is very poorly represented at Bernard harbour; only found a few plants, representing *J. triglumis*, *J. arcticus*, *J. biglumis*, i the swampy places on the slopes facing the large creek west of the station *Caltha palustris* forma *radicans* and *Ranunculus Pallasii*, which are very typica plants in the tundra ponds at Camden bay, were not observed at Bernard harbour. On the other hand *Parnassia Kotzebuei* may be termed a plant typical o the moist, stony places along the creeks and lakes at Bernard harbour; it was not observed along the coast farther west, except on Herschel island.

The outlet of the large creek from the big, shallow lake has the form of a deep, wide channel with muddy bottom, cutting through extensive tundra swamps. These contain a few large, shallow ponds close to the creek and also form bights along the latter, filled with a dense growth of *Arctagrostis latifolia*, *Hippuris vulgaris* var. *maritima*, etc. The tundra swamps also surround the creek in the upper half of its course, though its bed is mostly composed of gravel, and are populated by *Eriophorum angustifolium*, *E. Scheuchzeri*, and various grasses. However, where the bedrock outcrops are reached, about half the distance to the sea, the creek cuts through higher, gravelly tundra or comes close to the gravel ridge following it on the north side. Making a sharp bend it runs over gravelly bottom with a scarcer or richer vegetation along and in it, made up almost exclusively of *Carex rigida* and *C. pulla*. From August on the creek can be easily forded almost anywhere in this part of its course. A little farther down it cuts through a small exposure of bedrock which also forms its bed for a short distance, but otherwise its lower course lies enitrely between higher stony or clayey tundra, forming bluffs on both sides of the boulder-filled creek bed. Its outlet into the sea is first very shallow and composed of a wide, stony bed surrounded by tundra plains, but when the sandy beach region has been reached it becomes narrower and deeper as it merges gradually into the long, narrow bay.[1] A very characteristic and fairly common plant for the small, gravelly and sandy islands in the mouth of this creek is *Epilobium latifolium*. This species is practically not found at other places at Bernard harbour. In the inundated parts of the creek mouth the vegetation is scarce and mainly found in shelter of boulders, where certain species of mosses, *Carex*, *Dupontia Fischeri*, and other grasses compose it.

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[1] See fig. 3, p. 6, in vol. VII, Pt. E, Plate III, fig. 2, in Vol. VII, Pt. N, and fig. 1, p. 5, Vol. IV, Pt. A, of thes reports.

[2] Report of the Canadian Arctic Expedition, Vol. VII, Part, N, Ottawa, 1923, (Plate II, fig 2)

[3] See Plate I, fig. 2, in Vol. IV, Pt. A, and Plate II, fig. 1, in Vol VII, Pt. N, of these reports

The tundra swamps surrounding the lakes and ponds at Bernard harbour are almost entirely made up of mosses and *Carex*, with a sprinkling of certain other plants, such as *Salix reticulata*, *Polygonum viviparum*, *Oxyria digyna*, *Saxifraga aizoides*, *S. Hirculus*, *Pedicularis sudetica*, *Senecio palustris*, besides fungi and a number of plants more characteristic of the drier and higher tundra from which they have spread.[2]

Certain plants, for instance *Arctostaphylos alpina* and *Vaccinium uliginosum*, may perhaps be included among those characteristic of the moist tundra swamps at Bernard harbour, as they are found mainly and attain their best developement in the small gullies between the dry tundra banks and slopes on both sides of the large creek, but they are also found in shelter of large boulders from the lowland to the top of the ridges.

Tofieldia palustris, *Ranunculus pygmaeus*, *Primula sibirica*, and the three species of *Juncus* mentioned above seem at Bernard harbour to be found almost solely in moist places on the sandy slopes and bluffs a little inland[3] where, together with mosses, *Salix reticulata*, *Polygonum viviparum*, *Oxyria digyna*, *Saxifraga aizoides*, and *Arctostaphylos alpina*, they compose most of the vegetation which in such places generally is more luxuriant than anywhere else in the district.

The more typical coastal tundra covering dry, sandy, or gravelly soil is made up of a comparatively large number of plants, including *Equisetum arvense*, *Calamagrostis purpurascens*, *Trisetum spicatum*, *Poa arctica*, *Festuca ovina* var. *brevifolia*, *Carex* spp., *Salix anglorum*, *Silene acaulis*, *Lychnis apetala*, *Cerastium alpinum*, *Ranunculus affinis*, *Papaver nudicaule*, *Draba* spp., *Eutrema Edwardsii*, *Sisymbrium sophioides*, *Saxifraga decipiens* var. *groenlandica*, *S. tricuspidata*, *S. oppositifolia*, *Dryas integrifolia*, *Potentilla* spp., *Astragalus alpinus*, *Oxytropis* spp., *Hedysarum Mackenzii*, *Androsace Chamaejasme*, *Castilleja pallida*, *Pedicularis lanata*, *C. capitata*, *Plantago lanceolata*, *Erigeron compositus*, *Chrysanthemum integrifolium*, *Artemisia* spp., *Taraxacum* sp.[4]

Some of these, viz.: *Equisetum*, *Lychnis*, *Papaver*,[5] *Eutrema*, are however by no means common and occur more isolated here and there: others, viz.:

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[1] See Plate I, fig. 1, in Vol. IV, Pt. A, of these reports

[2] See fig. 4, p. 7, Vol. V[illegible], Pt. E, of these reports

[3] *Primula stricta* occurs in similar places but nearer the beach.

[4] See Plates I–III, in Pt. A, of this volume.

[5] See Plate I, fig. 2, in Pt. A, of this volume

Trisetum, Ranunculus, Hedysarum are perhaps more characteristic of less c
ered, sandy or gravelly stretches; while the rest, particularly *Carex, Sa*
Silene, Saxifraga, Dryas, and *Pedicularis* form the bulk of the vegetation on
dry tundra, together with a number of mosses and lichens. (Plate IX, fig. 2

Carex rupestris, Cerastium, Potentilla, and *Oxytropis* are perhaps, besi
certain tuft grasses, the most characteristic plants on the more barren gra
plains; but where the plains mainly consist of clay the following characteri
plants occur almost exclusively, viz.: *Tofieldia palustris, Lychnis affinis, Dr*
alpina, Braya purpurascens, Parrya macrocarpa, Primula stricta (mainly n
the beach), *Chrysanthemum integrifolium. Tofieldia palustris* and *Parrya mac*
carpa are however rather rare and seem only to be found on moist ground.

To the above lists of the plants occurring on the drier tundra should a
be added those occurring mainly in the tundra swamps but which spread o
to moist places, depressions, small gullies, etc., on the drier ground.

The gravel ridges and slopes near the coast have a vegetation which
best developed upon the south-facing slopes, particularly where these are som
what sandy. In places where the ground is made up of limestone, to the exclusi
of surface soil, the lichens make up the bulk of the vegetation, and only in sma
pockets here and there a few hardy plants occur, such as mosses, *Saxifra*
oppositifolia, Dryas, Potentilla, etc. This refers particularly to the tops of t
points in which the gravel ridges from inland reach the sea.

The more gravelly, clayey, or sandy parts of the ridges have generally
good vegetation, particularly in places which have some protection from t
wind and where, in the case of sandy soil, the plants have been able to conqu
the ground without later being deprived of it. In this connection it was inte
esting to observe the sandy slope on the south side of the peninsula facing t
bay just south of the station. It is covered by a dense growth of *Salix angloru*
Silene acaulis, Dryas integrifolia, Potentilla, Oxytropis, Hedysarum Mackenz
etc., in the form of "nigger heads" partly covering the sand. The sand, how
ever, is being hollowed out and carried away by melt-water in the sprin
and by the force of the wind so that some of the plant pillows are tumblin
down, though still retaining life and showing many flowers. (Plate VII, fig.
Plate VIII, fig. 1).

The following may be considered typical plants for the sandy slopes, viz
Calamagrostis purpurascens, Poa arctica, Festuca ovina var. *brevifolia, Care*
scirpoidea, Salix anglorum, Cerastium alpinum, Anemone parviflora[x][1], *Lesque*
ella arctica[x], *Hesperis Pallasii*[x], *Saxifraga decipiens* var. *groenlandica, S. tr*
cuspidata, Dryas integrifolia, Potentilla spp., *Astragalus aboriginorum*[x], *Ox*
tropis spp., *Hedysarum Mackenzii, Androsace Chamaejasme, Plantago lanceolat*
Campanula uniflora, Erigeron uniflorus[x], *Antennaria alpina*[x], *A. candida*
Artemisia sp., *Arnica alpina*[x].

Some of the illustrations accompanying this report (See also Pt. A, Plate I
fig. 1, of this volume) show better than many words how certain species dominat
where they occur, to the exclusion of other plants, and how luxuriant a vegetatio
certain places on the slopes have. As a matter of fact, not even the lower, mor
plant-filled tundra shows such a variety of different, well-developed plants a
do certain parts of the slopes. Covered during the winter and spring with
deep layer of snow which melts under the strong influence of the midday su

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[1] The plants marked with an x are particularly typical

as the summer progresses, the plants grow quickly and during the height of the summer exhibit their blue, red, yellow, or white cymes and stars to the delight of numberless insects and children of mankind. Gentle summer breezes imbibe the lovely odour of these many flowers and carry it down to lower levels, where it mingles with the evaporation from ponds and swamps and is felt even on the sea.'

Inland Area

A kind of transition zone between the coastal tundra and the bedrock table-land inland is formed by more or less extensive stony or clayey gravel plains with swampy depressions, lakes and ponds, which intervene between the ridges of sand, gravel, and boulders, stretching from the hinterland to the coast. Taken as a whole, these plains are exceedingly barren of vegetation, having only scattered plants of grasses, *Silene acaulis*, *Draba*, *Saxifraga oppositifolia*, *Dryas*, *Potentilla*, and a few others. *Alsine verna* var. *rubella* is perhaps the most typical plant for these gravel plains. The swampy depressions, however, have usually a rich vegetation of *Carex*, *Eriophorum*, etc. The only other vegetation to speak of is found on top of certain hummocks which melt free of snow early in the summer and are the favourite camping places for the Eskimos when travelling inland. These plains often stretch far inland over areas where no outcrops of bedrock occur, but are not very markedly set off from the adjoining ridges.

Certain plants, viz.: *Salix pulchra*, *Betula glandulosa*, *Cardamine digitata*, *Rhododendron lapponicum*, *Cassiope tetragona*, *Vaccinium uliginosum* forma *microphylla*, *Pedicularis arctica*, and one or two others may be said to be typical for the dry tundra swamps or slopes inland and do not occur right at the coast in the vicinity of Bernard harbour, according to my observations. (Plate VIII, fig. 2) In the case of *Salix* and *Betula* the reason apparently is the greater amount of protection from the wind given them inland; and this is also shown by their luxuriant growth in the shelter of large boulders or in depressions, small gullies, etc., where others plants also reach an unusual development.

While the gravel ridges right at the coast are very barren except on the south sides and in particularly protected pockets, their vegetation a few miles inland is far better, both on the tops and slopes. Particularly where many boulders are scattered the vegetation is rich, and in the depressions mosses, *Cassiope*, *Vaccinium*, etc., are common. Different lichens and grasses, *Silene*, *Draba corymbosa*, *Saxifraga oppositifolia*, *S. tricuspidata*, *Dryas*, *Potentilla*, *Pedicularis lanata*, are by far the most predominant plants on the ridges; it is only in particularly favourable places that other plants, such as *Carex* and *Chrysanthemum integrifolium*, are conspicuous. During all my stay at Bernard harbour I was unable to find any plants which might be considered typical to the tops of the hills or gravel ridges and which were not also found on the surrounding lower ground in places where the soil was similar. The character of the

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Men who are familiar with Arctic conditions have criticized many of the accompanying photographs of Arctic plant assemblages as giving an exaggerated idea of the size of most of the plants. In order to make the species of low or dwarfed ground vegetation identifiable in a picture it has been necessary to bring the camera very near to the object, losing depth of background, and giving no just standard of comparison. For photographic purposes, thrifty, well developed specimens have usually been chosen, showing the grouping of locally associated species, so that such pictures are typical of the possibilities of particular plants growing in favourable situations, rather than of their depauperate or even average aspects under other conditions. Some of the less hardy species, moreover, are local in their Arctic distribution, and are not found except in an abnormally sheltered habitat.

The author's report on "Insect Life on the Western Arctic Coast of America, Part K of Volume III, Report of the Canadian Arctic Expedition, 1913-18," is in a measure complementary to the present botanical paper. The insect life of the Arctic, as elsewhere, is to a large extent dependent upon the plant life, and the twenty photographic reproductions accompanying the paper on insect life are in some ways better adapted than the illustrations of the present paper to giving a fairly complete bird's-eye view of the average vegetation in each of the different types of country visited by the expedition.—Ed.

vegetation near the coast thus seems to depend much more upon the charact of the soil than upon altitude. Thus, upon the hill tops or slopes stony plac are rather barren, except for lichens, while depressions, in the shelter of larg boulders or surrounding occasional ponds, have a good and sometimes luxurian vegetation of many different plants, indeed, perhaps even a better vegetatio than at a lower level where the same plants occur.

Besides *Salix pulchra* and *Rhododendron lapponicum*, typical for the dr tundra swamps inland, the valleys between the ridges inland contain all th typical swamp plants found in the valleys nearer the coast, for instance, grasse *Carex* spp., *Salix reticulata*, *Pedicularis sudetica*,[1] *Senecio lugens*, *S. frigidus*.

So far as my information goes, the country inland for about a dozen mile west and south of our winter quarters at Bernard harbour is very similar in it topography and vegetation to the coast proper. While west of the statio dolomite crops out only about a mile inland in the bed of the large creek, i first occurs, south of the station, at a much greater distance inland, and at a elevation at least twice as high (about 50 feet). The rock exposures inland however, are much more extensive in a southerly than in a westerly directio so that it may be said that the higher land inland southwest of the station i composed mainly of bedrock, with a "coastal" margin to the north and south It consists of flat beds of white-grey dolomite rock showing, often to a larg degree, weather erosion on its surface, so that many cracks and more or les free and raised rock pieces are formed. Unlike the boulders of glacial origin which are scattered all over the district, the bedrock is not to any extent covere with lichens apart from the least eroded parts. On its surface are many depressions, containing a number of temporary or permanent ponds, and the vegetation is particularly developed as swamps in the depressions.[2] Generally speaking this higher rocky land is fairly well set off from the low coastal land north and east of it. It is conspicuously level on the top and thus forms a kind of tableland with a few higher, more or less isolated gravel ridges here and there, stretching from west to east. Some of these gravel ridges are continuations from the higher land farther inland. Largely owing to the presence of the bedrock, the valleys between them are far less developed than in the coastal zone, except along the few large creeks and lakes.

I could find no plants on these outcrops of bedrock which did not also occur in gravelly or sandy places nearer the coast. *Saxifraga tricuspidata* is, however, a very common and typical plant growing in large, spreading pillows scattered over the surface. Two other species of *Saxifraga*, viz.: *S. oppositifolia* and *S. cernua*, besides mosses and lichens, may perhaps also be included among the plants typical of the bedrock, apart from its swampy places.

LISTON AND SUTTON ISLANDS[3]

Liston and Sutton islands and the smaller islands of the same group in Dolphin and Union strait, between Bernard harbour and Wollaston peninsula, were visited by members of the Canadian Arctic expedition only during the winter and spring, when the land is covered with snow and it is difficult to get a good idea of the vegetation.

The geological make-up of the islands is described in Part A of Vol. XI of this series, by Dr. J. J. O'Neill, based partly upon observations and collections I made there in March and April, 1916. It is therefore enough to state that they are mainly made up of a much eroded conglomerate formation of palaeozoic dolomite, in the form of smaller, isolated rock exposures or larger, higher cliffs, with many stretches of gravel and fragments in between. Upon the gravel or tundra stretches are found the same plants as occur along the coast at Bernard harbour, particularly on Chantry island, to which Liston and Sutton islands seem to correspond closely, in regard to vegetation, although they perhaps contain a few more species of plants, owing to their larger size and proximity to Victoria island. They are also said, by Eskimos, to contain one or two large trout lakes while nothing beyond ponds are found on Chantry island.

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[1] In this connection it may be mentioned that the difference in occurrence between the four species of *Pedicularis* found at Bernard harbour is very striking. *P. lanata* is scattered as single plants all over the tundra and the gravel ridges. *P. capitata* occurs in clumps mainly on certain small hummocks, elevated from the rest of the tundra and with a rich vegetation. *P. sudetica* is a plant typical of the wet tundra swamps, while the less common *P. arctica* is perhaps as characteristic for the dry tundra swamps inland.

[2] See fig. 2 on Plate VIII, Vol. III, Pt. K, of these reports.

[3] See also Vol. XII, Pt. A, p. 26, of these reports.

It was interesting to observe, in April, 1916, the following plants which seemed to grow exclusively upon, or to be particularly characteristic of the dolomite cliffs, both in crevices and upon the flat surface, viz.: various algae, mosses, and lichens, *Saxifraga tricuspidata*, *S. oppositifolia*, *S. cernua*. Of the three species of *Saxifraga* the last named seems to grow exclusively on the dolomite cliffs.

CORONATION GULF

Topography

I am indebted to Dr. R. M. Anderson for the following general description of the Coronation gulf region:[1]

> "Coming into Coronation gulf, after passing cape Krusenstern at the eastern end of Dolphin and Union strait, a distant glimpse is given of the diabase islands of the Duke of York archipelago. The rock exposures of the peninsula between cape Krusenstern and Locker point are of the same dolomite limestone which is exposed here and there along both sides of Dolphin and Union strait, and the soil in general is rather sterile, with many loose, sharply broken stones and a rather scanty vegetation.
>
> "The northwest side of Coronation gulf, from the north side of Basil Hall bay to cape Hearne and beyond, is rather low with sandy beaches, rising gradually to low, stony hills behind them. The first precipitous cliffs begin at cape Kendall, a dark-coloured diabase overlying sandy limestone. Similar exposures are found around Back inlet, alternating with lower valleys which have tundra vegetation and dwarf willows. The first willows of any consequence in this region appear a few miles up Rae river, according to Mr. J. R. Cox, at rather frequent intervals, but there is no growth of spruce or other timber nearer than the trees on the Coppermine river.
>
> "There are some rather low stony or boulder island lying off the mouths of the Coppermine river, but as a rule the numerous islands of Coronation gulf have quite a different and distinctive character, in that they lie in parallel series, approximately east and west, consisting of vertical sea-cliffs running up to 200 feet in height, facing to the south or southeast and sloping down to the sea on the north or northwest. The slope of the top forms an angle of about fifteen degrees with the horizon, giving deep water at the foot of the cliffs, and a gradually deepening rock-bottom on the opposite side of the islands.
>
> "The same terraced formations of diabase rock are continued on the mainland south and southwest of Coronation gulf, from cape Kendall to about the Sandstone rapids of the Coppermine river, about thirty miles south of Coronation gulf on the east side of the Coppermine. West of the Coppermine river the beach is low and sandy around Mackenzie bay, with rolling hills behind. Except on the diabase terraces, the country here is fairly well grassed, with patches of ground willows here and there. Some of the hills are of a light-coloured, almost white, clay formation. Patches of willows of some size are found in some of the small gullies and valleys leading up from the Coppermine river.

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[1] See also pp. 17–23 in Vol. XII, Pt. A, of these reports.

"East of the Coppermine river the beach is usually sandy, with cla and gravel hills behind. The Naparktoktuok, a short river which flow out through steep clay hills about ten miles east of the Coppermine, ha a few small spruce growing in the valley within ten miles of the coast several miles north of the northern limit of trees on the Coppermin itself. The Kogaryuak river, about eighteen miles east of the Coppermine river, has a comparatively level, sandy coastal plain two or thre miles wide near its mouth, with a number of small shoal lagoons an ponds on the surrounding tundra. Willows grow four or five feet high mile or two up this stream. Back of the narrow coastal plain are shor diabase ridges here and there, among which, at the base of the talus slopes are narrow, sloping passes grown with deep tundra moss and 'niggerhead' tussocks of cotton-grass (*Eriophorum*).

"The country on the south side of Coronation gulf is in genera about the same for about sixty-five miles east of the mouth of the Coppermine river, to a point a few miles west of port Epworth or the mouth o Tree river, where the granite appears on the coast in the form of rounde granite knolls and small rounded granite islands fringing the coast East of this point the granite is often overlain with quartzite, shale sandstone, or dolomite, but the basic rock is granite.

"Tree river, known to the Eskimos as Kogluktualuk, flows for it last few miles through a narrow valley of clay hills, with numerou thickets of willows near its banks.[1] Like all the other rivers of thi region it has falls or rapids within a few miles of its mouth. In the somewhat sheltered valley of this river the flora is considerably richer tha on the coast, and the local natives say that it has some spruce on one of it branches which heads farther west, not far from the Coppermine. S far as is known, there is no timber on any Arctic-flowing river east o Tree river, and outside of the scanty timber on the lower Coppermin river there is probably no other timber nearer than the valley of the Thelo or Akkilinek river, which flows into Chesterfield inlet. Backs river i said to have no timber on any part of its course.

"Where not hidden by later formations, the granite appears her and there east of cape Barrow until it becomes the prevailing rock at th surface in the southern half of Bathurst inlet and eastward. The granit country in general is barren on the rugged summits and slopes, excep for lichens which are usually gray, but in some places give a reddis appearance to great areas on the hillsides. From the tops of the hill careful inspection shows many bright green patches in little valleys o gullies, or in small basins in the rocks where a little soil has collected In such places, low dwarf willows, sphagnum moss, cotton-grass, an other species have gained a footing. Arctic heather often grows luxuriantly in small patches, on shelving rocks, and a few flowering plants ar seen.

"A noticeable characteristic of the rounded hill granite country is th large number of small ponds and lakes, mere rock-bottomed basins o depressions in the granite. Owing to the slight rainfall and the shor season for evaporation of water, these basins are fed by melting sno which lies long and late in the settled drifts in the valleys. They are no contaminated by silt or by dissolving minerals from sedimentary rocks and are usually clear as crystal. Frequently having no outlet, the merely fill up until the surplus water flows over the rim of the basin int one lower down, so that many of the lakes are connected in this way.

"For two or three miles back from the mouth of Wentzel river, th soil is very sandy, with rock outcropping here and there, supportin little but a few sparse, coarse grasses. The islands from Grays bay east are little granite outliers here and there near the coast, wave-worn and sometimes almost awash. Outside of the coast islands, Hepburn island, Jameson islands, and others are of the usual Coronation gulf diabase type. The coast line being usually rugged, there is little place for the lagoons which are a feature of the coast farther west. The eastern end of Coronation gulf and of Bathurst inlet is rather a coast of long, narrow, rocky fjords cutting deeply into the land.[1]

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[1] See Plate II, in Vol. III, Pt. K, of these reports.

"North of Moore bay, and lying two or three miles outside of the Detention harbour granite islands, are some rather large islands of stratified dolomite, cut by a large dike of diabase which also appears inland on the mainland near there. At Kater point, the diabase cliffs are high and bold, with lower ridges to the southward, merging into a low, sandy shore towards the mouth of Hood river. Hood river has its entrance partly masked by a number of low, sandy islands. The river has high-cut banks of muddy clay for three or four miles, with willows five or six feet high and one inch or more in diameter in some of the bends. At the first cascade, nine or ten miles from the mouth of the river, the steep clay banks are about 100 feet high, with a level grassy bench extending back about half a mile to a ridge of fine, red sandstone, cut on the north side by a dike of coarse-grained diabase with a broad, grassy valley beyond. The next ridge is quartzite, succeeded by another grassy valley with granite hills farther on. A few caribou were seen in the grassy valleys here, but in most of this region the pasturage is too limited near the coast to support many caribou, although some numbers pass through in migrations.

"The shores and islands of Bathurst inlet east of Arctic sound are mostly rocky and rugged, similar to the Coronation gulf islands in general appearance, although much higher and more rugged. The diabase overflow characterizes the surface features of the northern part of Bathurst inlet, overlying granite, quartzite, or dolomite as the case may be. The shore of the south end of Arctic sound is low and sandy for a short distance, but the country behind is very rugged. East of Hood river the low land and soil deposits are much less frequent and the vegetation consequently more scanty. Heather and other plants were found in places and even a few dwarf blueberries (*Vaccinium*) on Barry island, but in practically no place east of Hood river could we find willows large enough to be of any practical use as fuel, although in some places the Eskimos were able to gather enough creeping ground willow stems in spring, and in some places dwarf birch enough to make small fires.

"South of Arctic sound, and the south and east sides of Bathurst inlet, the country appears to be a very high, rough, granite country, and the Eskimos who hunt there state that it is very barren and difficult to travel over, in many places almost impossible to negotiate except by packing in summer. South of Arctic sound appears to be about the western limit where the muskoxen are said to be at all common, although a few are said to be found as far west as Grays bay. Some of the natives of the Bathurst inlet region make overland trips to Backs river and the Akkilinek (Thelon) river, principally to get spruce wood from the latter river valley. The diabase rock on some of the islands of Bathurst inlet and a certain area of the mainland contains native copper in amygdules and small veins, but most of it appears to be of rather low grade. The Eskimos of the region hammer out many of their crude implements from this copper, which is usually found as float pieces on the shores."

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[1] See Plate X, fig. 2, in Vol. III, Pt. K, of these reports.

VEGETATION

West Side of Coronation Gulf

Concerning the lower Coppermine river, the observations herewith giv are mainly from a sledge trip made in February, 1915. The mouth of the riv is wide and while its east side is formed by a long and broad sandspit shooti out from a low, gravelly tundra plain lying at the foot of the clay hills, t west side of the mouth is formed by an outrunner from the gravelly clay ban up to about 100 feet high which a little farther up the river form the banks both sides. These banks are partly of marine,[1] partly of glacial origin, and a steep and barren, furrowed by melt-water on the side facing the river, b otherwise well covered with the typical tundra vegetation. Willows, reachi the height of a man, were noticed on the low, gravelly clay banks or islands the river mouth, but outside them they only occurred of any size on a sout exposed, protected place on the west bank of the mouth; and it was only as o ascended the large creek valleys coming down to the river that they attained similar or larger size. I followed such a creek valley on the east side a co siderable distance up and found that high, steep clay banks faced the cre valley in the same way as along the river itself, but with the difference that t willows attained a much closer growth and better development at the foot; especially protected places they reached more than double man-height, a some of them had trunks thicker than a man's arm.[2] The predominant speci of the bushy or tree willows is *Salix Richardsonii* but some of the fragmen (catkins, etc.) which I collected there have been doubtfully referred by Dr. Schneider to *S. glauca*, so that it would seem that this more southern speci comes very near the Arctic coast at least in the larger creek and river valley I collected a few plants sticking up from the snow on the top of the clay hills this creek valley; besides the willows mentioned they included *Festuca* sp *Lupinus* sp., *Plantago lanceolata*, *Achillea borealis*, *Artemisia vulgaris* var. *Tiles* *Lupinus* seemed to be much more common on the lower Coppermine than aroun Bernard harbour.

For the kind of plants that compose the vegetation, I refer to Richardson' general remarks about the coast between Mackenzie and Coppermine rivers, a to the appendix in Richardson's[4] account of his last expedition and to Hooker Flora.[5] No plants were collected by members of the Canadian Arctic expediti along the west side of Coronation gulf and the lower Coppermine river, exce those which I noticed sticking up from the snow and of which I took sample these species of course represent only a part of those actually present.

Bloody fall has been well described by the earlier explorers of the eighteen and nineteenth centuries and little that is new has been added since. The ea side of the gorge is formed of very steep and high cliffs, practically witho vegetation on the side facing the river; the vegetation is best developed (scru willows, etc.) upon the lower cliffs on the west side.

Above Bloody fall the river widens out considerably and has high, gravel and sandy cliffs on both sides, generally steep and barren towards the rive but often with "foreland" at their foot and with slopes and gullies on the side the latter with good vegetation (scrub willows, etc.). I also noticed a fe almost man-high willows on a south-facing slope on the east side of the riv just below the narrows above Bloody fall. Hanbury who passed here in t summer describes the country as flat or undulating and grass-covered, wit willow beds on either side; he also says that the river winds between low bank or in places without definite banks. At Escape rapid, farther inland, the hil attain the greatest height while along the river they have more the character of slopes, except where the river is bounded by cliffs. These slopes have a good vegetation of the typical tundra plants, and "nigger-heads" are abundant.

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[1] Pleistocene mollusks found by F. Johansen here Feb. 1915. See W. H. Dall, Mollusks, Recent and Pleistocen Report of the Canadian Arctic expedition, 1913-18, vol. VIII, Pt. A. Ottawa, 1919, pp. 26-29.

[2] See photo on p. 19, in Pt. B, of this volume.

[3] Franklin, J. Narrative of a Second Expedition to the Shores of the Polar Sea. London, 1828, pp. 264-65.

[4] Richardson, J. Arctic Searching Expedition, New York, 1852.

[5] Hooker, W. J. Flora boreali-americana. London, 1833-40.

Soon after passing Escape rapid, up-stream, the most northerly trees (white spruce) on the river are seen. They are represented by about a dozen dwarfed trees up to about four feet high, standing isolated or scattered up the steep west side. From there on, the trees increase in number and dimensions, here and there on the sides of the river; they are especially well developed in the mouths of small creek valleys coming down to the river, where some trees attain a height of about twelve feet. Except for dead trees, they gradually decrease in size and are more scattered higher up the slope, and soon disappear altogether. As one continues up the river, groves of white spruce, *Picea canadensis*, are seen more frequently, now on the west side, now on the east, everywhere having the same character, though better developed and more extensive the farther south one goes. I had a good opportunity to observe the spruce growth and vegetation, so far as I could for the snow, in a creek valley on the east bank of the river a few miles below Sandstone rapids in the middle of February, 1915. I collected samples of the tundra plants I saw sticking up from the snow and secured the following, viz.: *Calamagrostis* sp., *Poa* sp., *Salix anglorum*, *Saxifraga tricuspidata*, *Dryas integrifolia*, *Potentilla fruticosa*, *Lupinus nootkatensis*, *Rhododendron lapponicum*, *Kalmia polifolia*, *Cassiope tetragona*, *Arctostaphylos alpina*, *Vaccinium uliginosum*, *Saussurea angustifolia*, besides lichens and mosses. *Betula glandulosa* was also observed.[1]

The details about the spruce growth at this place will be found in a more popular article,[2] and are also discussed at length by Theo. Holm in Part B of this volume, pp. 86B-88B, figs. 1-3. It is therefore only necessary here to say that the trees grow almost exclusively upon the east bank of the river, and that the growth is much better, both as to the development of single trees and their extension, in spots protected from the northerly winds, than in more exposed places, while the character of the soil (tundra, shale cliffs, etc.) is of far less importance. The biggest trees I saw were up to 30 feet high and about 5 feet in circumference near the ground. Even small stunted trees proved, by counting the rings, to be about half a century old, while the largest ones may possibly reach an age of 500 years. A rich growth of lichens, of which samples were collected, were found on dead trees and on dead branches of living trees. Outside and among the present growth of living trees were found a number of dead trees or stumps, and many of the living trees of any size, especially those growing in a more open stand, were partly killed by forest insects. Very few young trees were seen and the appearance of the spruce growth as a whole, including both living and dead trees, was one of great antiquity, which was further proved by a close examination of each tree, small or large. Dr. Richardson[3] has already commented upon this and ascribes the present appearance of the woods, in particular the dead trees and stumps, to a deterioration of climate coupled with destructive fires. It remained however for us to prove that forest insects are very destructive to the spruce trees up north, and that a number of the trees had been killed or injured solely by these insects (bark-beetles, cerambycid-larvae), which were found in some of the trees to be as numerous as at latitudes much farther south.[4]

A year later, Feb. 1916, R. M. Anderson collected a few twigs of poplar, *Populus tremuloides*. The trees were about 10 feet high and their trunks attained the thickness of a finger; they grew in patches among willows and spruce in a deep gully, protected by rock slopes, just above Escape rapid, and all but the upper twigs were hidden by snow at that season.

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[1] Hanbury, who passed by here in the summer, says in his book that, after reaching the first spruce trees, vegetation of every kind was becoming more luxuriant.

[2] F. Johansen. The Forest's Losing Fight in Arctic Canada. Canadian Forestry Journal, Vol. 15, Ottawa, 1919, pp 303-05

[3] Arctic Searching Expedition, pp. 192, 416.

[4] J. M. Swaine Report Can. Arct. Exped., Vol. III, Part E, pp. 1-21, Plates I-III. Ottawa, 1919

The occurrence of ***Populus tremuloides*** here, about Lat. 67·5°N., is interesting. The species has previously been observed on Hulahula river, Alaska by Dr. Anderson[1] and in the delta of Mackenzie river. These three localitie therefore indicate its approximate northern limit on this continent.[2]

South Side of Coronation Gulf

A few points concerning the vegetation in general has been given on th preceding pages under topography; and as I did not visit the region myself I can only give a list of the known flowering plants, compiled from the publishe records of plants collected. Apart from a small collection made by R. M Anderson at the mouth of Kogaryuak river, 18 miles east of Coppermine river June 18th, 1911, I only know, of more recent collections, Hanbury's along thi coast in 1902. Members of the Southern Party of the Canadian Arctic expedition secured, in 1914 to 1916, fairly representative collections of plants at certain points, viz.: Tree river, cape Barrow, outer part of Bathurst inlet besides smaller collections at Grays bay and the inner part of Bathurst inlet These collections were made by Messrs. J. J. O'Neil, J. R. Cox, and R. M. Anderson. Hanbury's plants were identified by R. A. Rolfe[3] and the locality i merely given as the Arctic coast from Ogden bay to Coppermine river. Fro Hanbury's narrative[4] it appears, however, that coming from the east he firs began collecting plants in June at Bathurst inlet, and we can therefore mak use of his full list Anderson's plants from Kogaryuak river in 1911 wer identified by P. A. Rydberg.[5]

The vascular plants collected by the Southern Party of the Canadia Arctic expedition were identified by J. M. Macoun and Theo. Holm.[6] In th following list, species not secured by the Canadian Arctic expedition in the regio in question are marked with an *x*.

Vascular Plants[7]

Dryopteris fragrans
x *Woodsia glabella*
Equisetum arvense
Lycopodium Selago
Alopecurus alpinus
Arctagrostis latifolia
Poa hispidula
Festuca rubra var. *arenaria*
Bromus arcticus
Agropyrum alaskanum
Hordeum jubatum
Elymus mollis
Eriophorum Scheuchzeri
Carex stans
Carex vaginata
Juncus Haenkii
Salix anglorum
x *Salix arctica*
Salix reticulata
Salix fullertonensis

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[1] V. Stefansson, My Life with the Eskimos, New York, 1913, appendix, p. 441.
[2] See also Vol. V, Pt. B, pp. 93-94.
[3] R. A. Rolfe, in D. T. Hanbury, Sport and Travel in the Northland of Canada. London, 1904, pp. 276-77.
[4] l. c. p. 113.
[5] P. A. Rydberg, in V. Stefansson, My Life with the Eskimos, New York, 1913, pp. 446-47.
[6] J. M. Macoun and Theo. Holm, Report of the Canadian Arctic Expedition, 1913-18, Vol. V, Part A, Vascular Plant Ottawa, 1921, pp. 1-52 A.
[7] As these plants have been identified by three different botanists, it is probable that some of them are the same although listed under different names. This refers particularly to, *e. g. Stellaria longipes, Caltha palustris, Lupinus nootkatensis, Oxytropis campestris, Armeria vulgaris, Matricaria inodora, Senecio palustris*

Rumex arcticus
Oxyria digyna (*O. reniformis*)
Silene acaulis
Lychnis apetala
Lychnis affinis
x *Stellaria longipes*
Stellaria longipes var. *Edwardsii*
Cerastium alpinum
Halianthus peploides (*Arenaria peploides*)
x *Arenaria Rossii*
x *Caltha palustris*
Caltha palustris f. *radicans*
Anemone Richardsonii
Anemone parviflora
Ranunculus Cymbalaria var. *alpina*
Ranunculus lapponicus
Ranunculus affinis
Papaver nudicaule
x *Papaver alpinum*
Draba alpina
Draba nivalis
Draba hirta
x *Draba incana*
Hesperis Pallasii (*Cheiranthus pygmaeus*)
Cardamine digitata
Cardamine pratensis
x *Parrya arctica*
Erysimum inconspicuum
x *Erysimum lanceolatum*
Saxifraga cernua
Saxifraga Hirculus
Saxifraga aestivalis
Saxifraga nivalis
Saxifraga tricuspidata
Saxifraga oppositifolia
Dryas integrifolia
Dryas integrifolia f. *intermedia*
Potentilla fruticosa
Potentilla nivea
x *Potentilla nivea* var.
x *Potentilla biflora*
Potentilla emarginata
x *Lupinus arcticus*
x *Lupinus nootkatensis*
Lupinus nootkatensis var. *Kjellmanii*
Astragalus alpinus
Astragalus aboriginorum
x *Astragalus* sp. nova?
x *Oxytropis campestris*
Oxytropis campestris var. *sordida*
Oxytropis foliolosa
Oxytropis Roaldi
x *Oxytropis nigrescens*
Oxytropis arctobia
Hedysarum Mackenzii
Hedysarum alpinum var. *americanum*
x *Hedysarum boreale*

Empetrum nigrum
Epilobium latifolium
Pyrola grandiflora
x *Pyrola rotundifolia*
Ledum palustre
x *Ledum palustre* var. *decumbens*
Rhododendron lapponicum
Loiseleuria procumbens
Kalmia polifolia
Cassiope tetragona
x *Andromeda polifolia*
Arctostaphylos alpina
Vaccinium uliginosum f. *microphylla*
Primula stricta
x *Primula farinosa*
x *Armeria vulgaris*
Statice Armeria f. *sibirica*
Pleurogyne rotata
Mertensia maritima
Castilleja pallida
Pedicularis lapponica
Pedicularis hirsuta
Pedicularis sudetica
Pedicularis arctica
x *Pedicularis lanata*
Pedicularis capitata
Pinguicula vulgaris
Campanula uniflora
x *Aster sibiricus*
Erigeron uniflorus
Erigeron alpinus
Achillea borealis
x *Matricaria inodora*
Matricaria inodora var. *grandiflora*
Chrysanthemum integrifolium
Artemisia vulgaris var. *Tilesii*
Petasites frigida
Arnica alpina
x *Arnica montana* var. *angustifolia*
Senecio frigidus
Senecio frigidus f. *Shraderi*
x *Senecio palustris*
Senecio palustris var. *congestus*
Senecio lugens
Saussurea angustifolia
x *Taraxacum officinale*
Taraxacum ceratophorum
Crepis nana

According to O'Neill and Cox the dwarf birch, *Betula glandulosa*, is commo both along Tree river and in Bathurst inlet; at the former place it attains height of 3 feet. Willows (probably *Salix Richardsonii*) attain their maximu height, 10 feet, on Tree and Hood rivers.

Of the flowering plants listed above, Hanbury's were collected at the en of June and beginning of July, and Anderson's in the middle of June. Th collections made by the Southern Party of the Canadian Arctic expeditio were made from the middle of June to the middle of July at Tree river, and i

August and the beginning of September at Grays bay, Cape Barrow and Bathurst inlet.

From Hanbury's narrative we learn that in the middle of June, at Barry island, "one small flowering plant was already in blossom" and that "grass was observed to have begun growing at the roots."[1] Further, that on the east side of Bathurst inlet "there still was considerable snow in places, but it was melting fast, and the whole country was running with water." On June 20th, at the mouth of Bathurst inlet, "the grass was now rushing up" and "several flowering plants were already in blossom," and more than two weeks later, nearer the Coppermine river, "vegetation was very luxuriant, and the ground showed a profusion of blossom. The miniature rhododendron with its mass of red blossom, the white blossom of our old friend the *i-klu-ti*, the heather which had served us for fuel for so many days on Arm-ark-tuk river, and a white anemone were the most conspicuous."[2] On July 15th ***Lupinus nootkatensis*** was "still in flower."[3]

From the various data on hand we may conclude that the vegetation is at least a week earlier along the south coast of Coronation gulf and in Bathurst inlet than at Bernard harbour. This is of course due mainly to the more southern latitude, the difference being about one degree, but probably also to the fact that the climate is more steady and continental along the south shore of the gulf than in Dolphin and Union strait, and is not subjected to so many cold and stormy spells in May and June as at Bernard harbour. There is also every reason to believe that the subduing of the plant life in the fall comes later along this coast than at Bernard harbour.

Islands in Coronation Gulf

Apart from those close to the mainland south of Coronation gulf, the many islands scattered over this body of water were not visited by members of the Canadian Arctic expedition, except in winter and spring, and then only a few of the hundreds. Their general character has been given by Collinson[4] and Stefansson.[5] They consist mainly of basalt, diabase, sometimes underlaid by dolomite, according to the geological formation of the nearest mainland, including Victoria island; their eastern and southern parts show higher, steep cliffs, while their northern and western parts slope down to the level of the sea. Owing to their exposed situation and geological make-up, the vegetation is generally poor, except for occasional gullies or pockets, stretches with gravel, and the surroundings of ponds. As, however, the vegetation of isolated islands is interesting always mainly on account of the number of species not found upon them, I give herewith some information about the plants I observed on one of the three small islands belonging to the Duke of York archipelago and situated south of Lady Franklin point on Victoria island. I stayed two days there in the middle of March, 1916, at which time much snow covered the island, particularly the lower parts.

It is composed solely of dark basalt, which shows marked effects of glaciation upon its surface,[6] with many and often big boulders scattered over it. The bedrock shows fairly high cliffs on the northern and eastern sides of the island or runs out in lower rocky points, where it does not slope gradually into the sea as a smooth rock floor. On the south side there is a more extensive stretch of gravel beach which, by rising gently towards the north, intersects the island as a gravel slope until barred by higher cliffs. Here and there along the beach are small gravelly areas at the head of bights, and among the lower or higher cliffs are depressions, often with water accumulations or smaller gullies.

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[1] l. c. p. 164.
[2] l. c. p. 190.
[3] l. c. p. 192.
[4] l. c. p. 443.
[5] l. c. p. 237
[6] See Report of the Canadian Arctic Expedition, vol. III, Part K. Ottawa, Plate X, fig. 1.

Compared with Liston and Sutton islands in Dolphin and Union strai which, being composed of limestone or dolomite, are subjected to far quicker erosion, this basalt island is extremely barren, a feature which is still further emphasized by the thorough glaciation it has suffered. Apart from certain plants which are capable of growing upon the bare rock and in crevices, the vegetation is limited to the more sheltered places where the soil is gravelly o wet.

The following plants compose the whole vegetation upon the bare rock, or in crevices, viz.: different black or orange-coloured crust lichens, *Silene acaulis*, *Saxifraga oppositifolia*. The much more luxurious vegetation in places with more shelter and better soil was composed of the following plants, viz.: different lichens and mosses, *Dupontia* sp. and other grasses, *Carex* spp., *Luzula* sp., *Salix anglorum*, *Polygonum viviparum*, *Silene acaulis*, *Saxifraga tricuspidata*, *S. oppositifolia*, *Dryas integrifolia*, *Empetrum nigrum*, *Epilobium latifolium*, *Cassiope tetragona*, *Arctostaphylos alpina*, *Vaccinium uliginosum*, etc. Some o the above plants, viz.: grasses, *Salix*, and *Dryas* were also typical of the intermediate, drier soil.

In its geology, vegetation, etc., this island may be considered typical fo the many others of similar size and formation in this vicinity, though an examination at a more favourable time of the year probably will reveal a few more species of plants in addition to those given above.

WOLLASTON PENINSULA, VICTORIA ISLAND

The western part of this peninsula has an appearance very similar to tha of the mainland opposite, being of the same geological formation. From cap Baring to Simpson bay the coast is higher and rocky, but beyond is very lo and consists mainly of gravel or sand with boulders and lagoons, while the bedrock, limestone or dolomite, first crops out farther inland. East of Lady Franklin point the bedrock is a yellow sandstone, overlaid by limestone and, above by basalt, from Richardson island to Murray point, so that both the forme island and the coast opposite the sound show high and steep diabase cliff East of Murray point the land is very low, similar to the coast north of Lad Franklin point. Apart from Colville hills, a spur from the "Museum range, the interior of the peninsula is made up of lower plains of clay or gravel, wit tundra and swamps surrounding lakes and ponds, the bedrock not being muc in evidence. Two large rivers come out into Simpson bay, but none of an size south of it.[1]

The ethnologist of the expedition, D. Jenness, spent the summer o 1915 in the interior of the northern part of the peninsula, and the followin spring, March-April, I made a sled trip along the coast farther south fro Forsyth bay to Murray point. Both Mr. Jenness and I collected plants, an in addition I made some observations about the vegetation along the part o the coast I visited.

From the reports of Stefansson and Jenness, who crossed the Wollasto peninsula in spring, the latter spending the spring, summer and fall ther it appears that the spring or early summer comes from a week to a month lat than upon the mainland coast south of it. Consequently the development o the plant life is later too, generally starting at the beginning of July, thoug short spells of warm weather in May and June may melt much of the snow an ice and bring forth some flowers on the earliest plants, for instance, *Saxifrag oppositifolia*, willows, etc. Subsequent spells of poor weather in the san months retard their development, however. During July and most of Augu the land is free of snow, but snow and frost come in the end of the latter mont and, from the beginning of September on, the winter may be said to have set i at least a week earlier than upon the mainland coast.

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[1] See Vol. III, Pt. K., Plate VI, fig. 2, and Vol. XII, Pt. A, pp. 24-27, of these reports

The following is a list of the plants secured, to which are added the few collected by R. M. Anderson,[1] east of point Williams in July, 1911.

Cystopteris fragilis
Trisetum spicatum
Poa abbreviata
Poa arctica
Festuca rubra var. *arenaria*
Agropyrum alaskanum
Elymus mollis
Eriophorum angustifolium
Carex rigida
Carex compacta
Luzula sp.
Salix anglorum
Salix reticulata
Salix phlebophylla
Salix Richardsonii
Betula glandulosa
Polygonum viviparum
Oxyria digyna
Silene acaulis
Lychnis apetala var. *arctica*
Lychnis affinis
Anemone parviflora
Ranunculus affinis
Papaver nudicaule
Draba alpina
Draba nivalis
Braya purpurascens
Braya alpina
Parrya macrocarpa
Saxifraga tricuspidata
Saxifraga oppositifolia
Dryas integrifolia
Potentilla pulchella
Potentilla nivea
Potentilla Vahliana
Lupinus arcticus
Astragalus alpinus
Oxytropis campestris var. *sordida*
Oxytropis Roaldi
Hedysarum Mackenzii
Epilobium latifolium
Rhododendron lapponicum
Cassiope tetragona
Arctostaphylos alpina
Vaccinium uliginosum
Androsace Chamaejasme
Statice Armeria f. *sibirica*
Mertensia Drummondii
Castilleja pallida
Pedicularis lanata
Pedicularis capitata
Plantago lanceolata var.
Aster sibiricus

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[1] P. A. Rydberg, in V. Stefansson, l. c., p. 447.

Erigeron uniflorus
Erigeron compositus
Chrysanthemum integrifolium
Artemisia hyperborea
Arnica alpina
Senecio palustris var. *congestus*
Senecio lugens
Taraxacum lyratum
Crepis nana

To the above plants should be added those collected by Dr. J. Rae on Wollaston land south of cape Baring and west of Long. 110°W., about seventy years ago.[1]

No spruce occurs upon Victoria island and the willows have the prostrate form usual in the Arctic, except in protected river beds and gullies where they attain the size of shrubbery and, very rarely, of small trees. The largest willow that Mr. Jenness saw was about 5 feet high, with a circumference of about 2 inches; it was growing at Kugaluk river near point Pullen, about two miles from the coast. I found a considerably bigger one, measuring about 8 feet in height and 10 inches in circumference at the ground. This tree, *Salix Richardsonii*, was growing in the bed of a small creek near the coast (Rae's "Mackenzie river") at about Long. 110°W. It is probably the biggest willow tree on Victoria island.[2]

Concerning the topography and vegetation in general along the south side of Wollaston land, between long. 110° and 114°W., it appears that from Simpson bay south of Lady Franklin point the coast is of the same nature, with low gravel plains, tundra, etc., as on the mainland opposite and that the vegetation is the same as at Bernard harbour. Some plants were collected at the mouth of Kimiryuak river, Forsyth bay, and at the head of Austin bay.

The coast from Lady Franklin point to Richardson island is composed of sandstone bedrock, gravel, and sand. The limestone overlying the sandstone is a mere fragment of formerly more extensive beds and only found at a few places, namely in the vicinity of "Mackenzie river." But the sandstone is predominant, and at a few places form real cliffs (Rae's "Hare Hills") though it is mostly present in the shape of flat beds. About half way between Miles island and point Ross is a reef composed entirely of this yellow, hard sandstone, close to Victoria island. The only vegetation upon it was found to be green algae growing in cracks of a few big blocks of sandstone. It may therefore be assumed that, though the reef rises to six feet above the water, the spray and sea-ice prevent the formation of vegetation. Some plants were collected on the tundra portage at the base of Ross point.

In the western part of the bay between Ross point and Richardson island the sandstone predominates in the form of flat beds, reaching the sea as low cliffs or as a smooth sloping floor merging gradually into the sea bottom. Here and there it is covered with gravel, sand, or tundra, and the "Mackenzie river" has cut a bed, mostly wide, through it. Near its mouth the "river" divides into a western and eastern branch of which the former is the most open; the high willows referred to above were therefore only found along the east branch. At the mouth of the latter is an isolated, lower, basalt outcrop, with a small island of the same kind of rock continuing it, while a remarkable square cliff formed by a basalt dyke intersecting sandstone and dolomite forms a distinct landmark a little inland between the two branches of the "river" outlet. From the top of this little cliff, and by going farther inland, one discovers that there is really no river at all but a system of creeks, swamps, and lakes, fed from inland and the surrounding higher slopes, and the "river" bed, which is fairly well marked near the coast, divides up into open gullies. Judging from the width and depth of the bed in the lower part of the "river" it must, however, have carried considerably more water formerly, because at one place it has cut its way through hard sandstone beds or higher gravel slopes. When I visited it the mouth was almost barred by a sandy islet, with fairly good vegetation, and there was very little water in its bed, which was mostly filled with islets or stretches with gravel and boulders upon which willows were growing in profusion and attained considerable size.

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[1] See J. D. Hooker, On Some Collections of Arctic Plants, etc. Proc. Linn. Soc. Bot. Vol. 1, p. 124. London, 1857.
[2] See Vol. V., Pt. B., p. 18, photo.

The vegetation at the mouth of this "river" is fairly good, particularly in the many swamps and tributary creeks. But often and over large patches, where the sandstone occurs as flat beds, the glaciated surface has no other vegetation than lichens. On the other hand the vegetation is good in the shelter of the low cliffs by which the sandstone sometimes reaches the coast. The landmark cliff mentioned above had no other vegetation than different mosses, algae, and lichens, growing upon its much eroded limestone. Besides lichens and mosses some plants were collected on the basalt outcrop at the mouth of the east branch of the river.

Between the outlet of "Mackenzie River" and the sound separating Richardson island from Victoria land there is a small, deep bay. The west side of this bay is made up of sandstone outcrops while on the east side the higher or lower basalt cliffs begin, which form the north side of the sound and compose the whole of Richardson island and the smaller intervening islands. This stretch of the coast of Victoria island has thus a much grander and more picturesque appearance than west and east of it, a fact already commented upon by Rae and Collinson. On Richardson island the cliffs attain their greatest height inland and fall off to the sea in the south precipitously, while towards the sound they have the form of slopes reaching the water as a smooth floor or as smaller, rounded outcrops with intervening bights, with the exception of a high cliff facing Murray point. The vegetation on this north side of Richardson island is surprisingly well developed, owing to the good protection afforded, not only upon the sandy soil at the head of bights and at the mouth of the various small creeks, but even on the patches of sand and gravel covering the glaciated rock floor. This good vegetation is found even to the top of the cliff on tundra slopes or in swamps, with grasses and *Carex*, *Salix*, *Saxifraga*, *Dryas*, *Cassiope*, *Vaccinium*, *Pedicularis*, as the dominating plants. The number of caribou, hares, ptarmigan, etc., observed in this sound also emphasizes the quality of vegetation present. Even where the cliff floor with its rock debris and scattered boulders is bare, vegetation is found in cracks; it seems to thrive even better on the decomposed basalt than on the more barren gravel of marine origin.

The islands in the sound between Richardson island and Victoria island show all forms of transition from flat rock-beds, only little above the level of the sea and much glaciated, to rounded, higher cliffs with precipitous sides, gentle slopes, and low jutting points. They are very similar in appearance to the islands in Coronation gulf and are composed of the same kind of rock but owing to their more sheltered location their vegetation is far better developed, particularly in places where the rock surface is decomposed or covered with sand or gravel. One of them, half way up the sound, had a particularly rich growth of lichens on the bedrock and boulders forming its higher part, and on another island, in the mouth of the sound, I collected a number of other plants sticking up from the snow.

The side of Victoria island facing the sound consists, as mentioned, also of basalt, and the cliffs there are for considerable stretches high and precipitous, with a slope of debris below, right to the water. The vegetation is therefore less developed than upon the Richardson island side.

The peninsula forming Murray point and closing the sound mentioned above towards the east, consists below of the same yellow brown sandstone as mentioned above, cropping out as flat beds at the level of the sea and overlaid by dolomite and basalt. The latter is by far the most predominant, composing most of the peninsula and particularly its higher parts. It rests either direc upon the sandstone or, where the dolomite yet remains, upon the latter, intersects it as dikes, with the characteristic "burned" transformation of rock in the zone of contact. Parts of the peninsula are, however, made up marine deposits of more recent origin, in the form of gravel stretches with lagoo and swamps intersecting the cliffs and connecting them with the low. san tundra north, east, and west. The vegetation on the peninsula was found to as well developed as over similar areas in the sound east of it, particularly gravelly stretches, and in pockets in the shelter of basalt outcrops. Only one place is there a free exposure of limestone resting on sandstone in the fo of a small cliff subjected to much erosion. The following are characteris plants composing the vegetation upon the side of this limestone cliff, viz.: T moss *Barbula Johansenii*, furthermore, *Cystopteris fragilis*, *Draba* sp., *Saxifr- tricuspidata*, *S. oppositifolia*, *Dryas integrifolia*.

Apart from these plants, some lichens, growing on basalt or limesto debris, were collected on a small island near Murray point. The islands ne by are composed entirely of limestone, while farther out in Coronation gulf t is overlaid or replaced by basalt. The basalt also composes the islands formi the bridge between Richardson island and the Duke of York archipelago. Th the coast of Victoria island east of Murray point is low and composed of san gravel, sandstone and limestone, has already been mentioned.[1]

REMARKS ON BEDROCK VEGETATION

From the description given of the vegetation occurring upon the bed ro outcrops or debris on the coast and islands from Young point in the west Murray point and cape Barrow in the east it will be seen that while there se to be no plants limited to the diabase or characteristic of it, except perha certain lichens and *Dryopteris fragrans*, the dolomite has about half a doz characteristic plants besides algae, mosses, and lichens, and *Cystopteris frag* and *Saxifraga cernua* seem to be limited to it. On the bare diabase outcro the vegetation is only found in crevices, with *Silene acaulis* and *Dryopte fragrans* as the most characteristic or only plants occurring. A list of pla characteristic of dolomite and diabase outcrops is:

Dolomite	Diabase
Algae	Lichens
Lichens	*Dryopteris fragrans*
Mosses	*Silene acaulis*
Draba sp.	*Saxifraga oppositifolia*
Cystopteris fragilis	
Saxifraga cernua	
Saxifraga tricuspidata	
Saxifraga oppositifolia	
Dryas integrifolia	

This comparative list, however, refers to solid rock only and not to pocke and similar places with a more decomposed soil; in the latter situations t vegetation is more varied, on diabase as well as on dolomite.

Apart from lichens and algae, I could find no plants typical to the sandsto outcrops on Victoria island.

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[1] For the coast along the north side of Dease strait see T. Simpson: "Narrative of Discoveries North America 1836-39, London 1843, pp. 382-8

PLATE

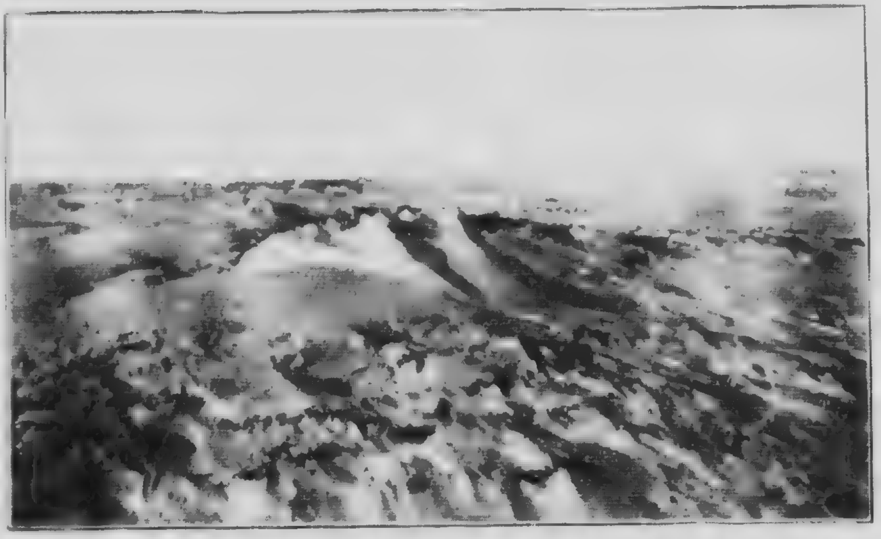


Fig. 1. Low hummock on coastal tundra, Collinson point, Alaska, February 27, 1914. The strong winds prevent snow from gathering except in gullies or depressions. Photo by F. Joh

dra at edge of Camden bay, Konganevik, Alaska, July 4, 1914 ick ground. Photo by F. Johansen.

PLATE II

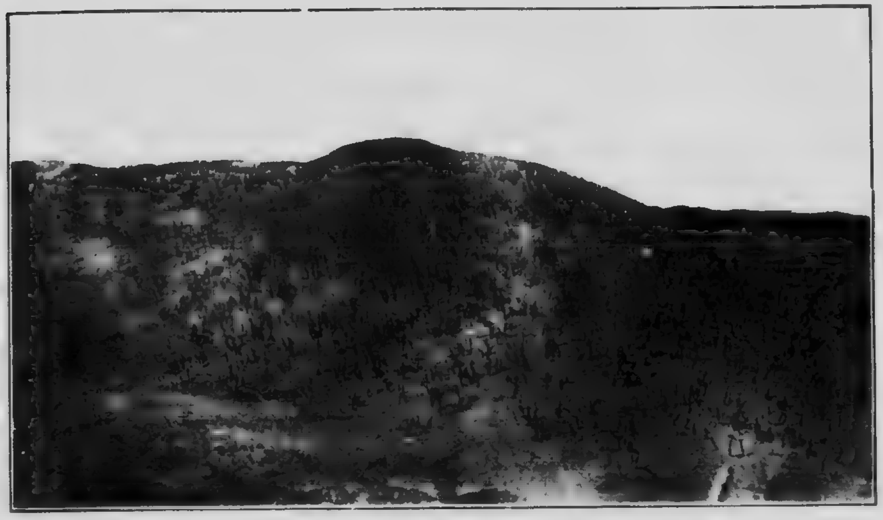


Fig. 1. Sand-dunes, Konganevik, Camden bay, Alaska, with *Elymus mollis* Trin. July 4, 1914 (Photo by F. Johansen)

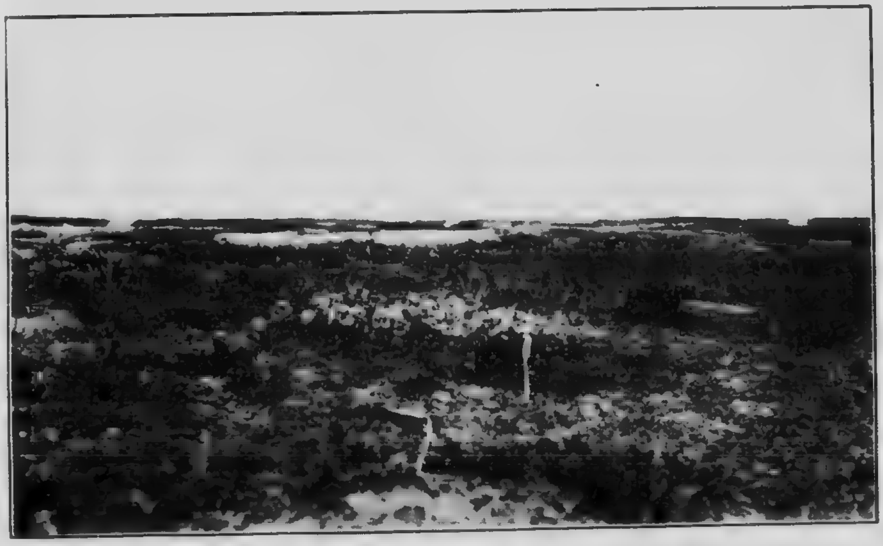


Fig. 2. Coastal flats, Collinson point, Alaska. *Polemonium boreale* Adams, *Saxifraga decipiens* Ehrh. var. *groenlandica* (L.) Lge., *Papaver nudicaule* L., *Artemisia*, etc. July 17, 1914. (Photo by F. Johansen)

PLATE III

Fig. 1. *Astragalus alpinus* L., in bloom at Collinson point, Alaska, July 17, 1914. (Photo by F. Johansen)

Fig. 2. Low hillside, Herschel Island, Yukon Territory. *Saxifraga tricuspidata* Rottb., *Selinum cnidiifolium* Turcz., *Bupleurum americanum* C. et R. July 29, 1916. (Photo by F. Johansen)

PLATE IV

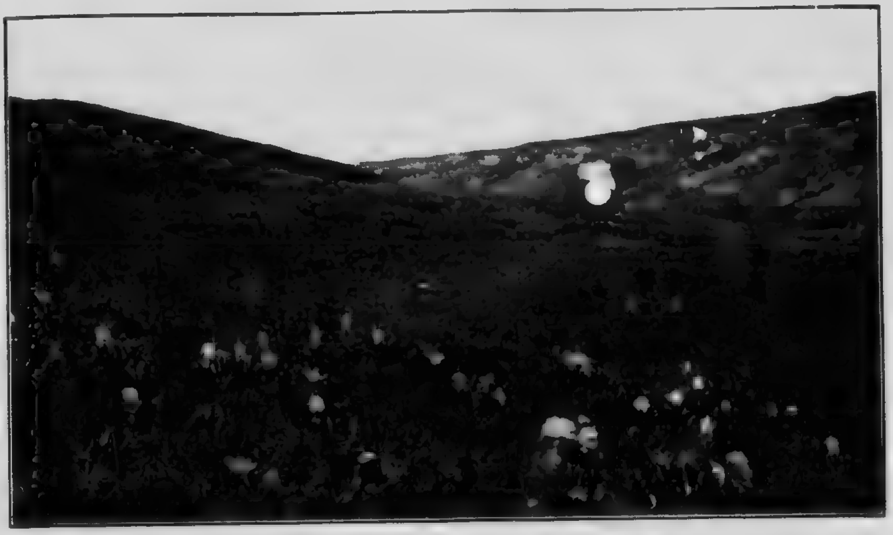


Fig. 1. Valley, Herschel island. *Lagotis glauca* Gaertn. var. *Stelleri* Cham. et Schl., *Parrya macrocarpa* R. Br., *Phaca frigida* L., and *Pedicularis capitata* Adams, in bloom. July 29, 1916. (Photo by F. Johansen)

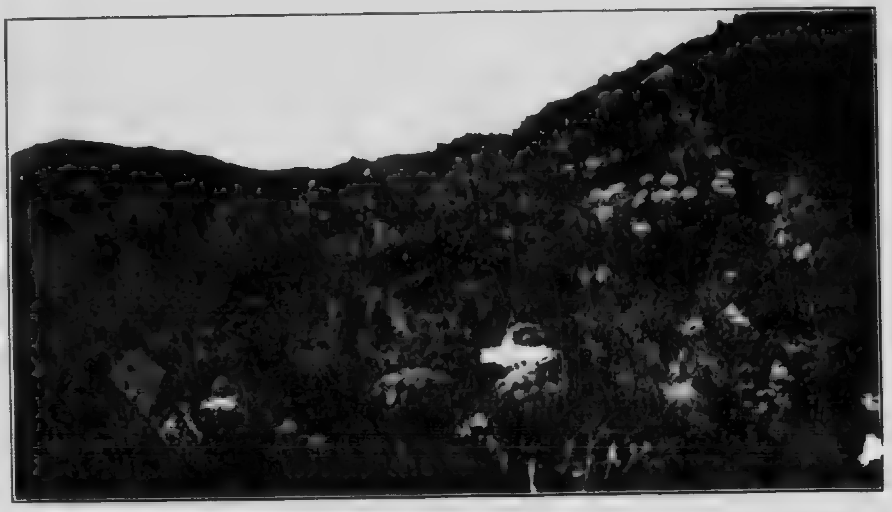


Fig. 2. Hillside, Herschel island. *Erigeron grandiflorus* Hook., *Selinum cnidiifolium* Turcz., *Myosotis silvatica* Hoffm., *Senecio frigidus* Less., in bloom. July 29, 1916. (Photo by F. Johansen)

PLATE V

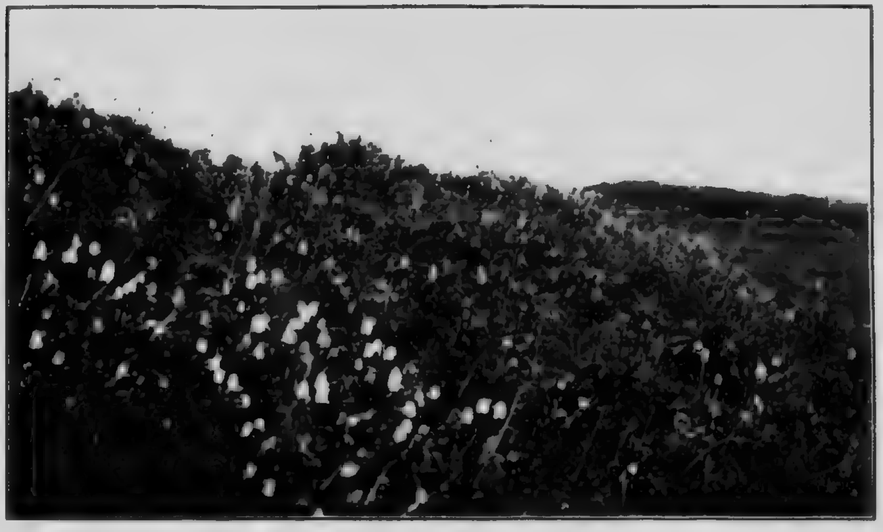


Fig 1. Bluff, Herschel island, with *Polygonum Bistorta* L., *Artemisia comata* Rydb., etc., in bloom. July 29, 1916.
(Photo by F. Johansen)

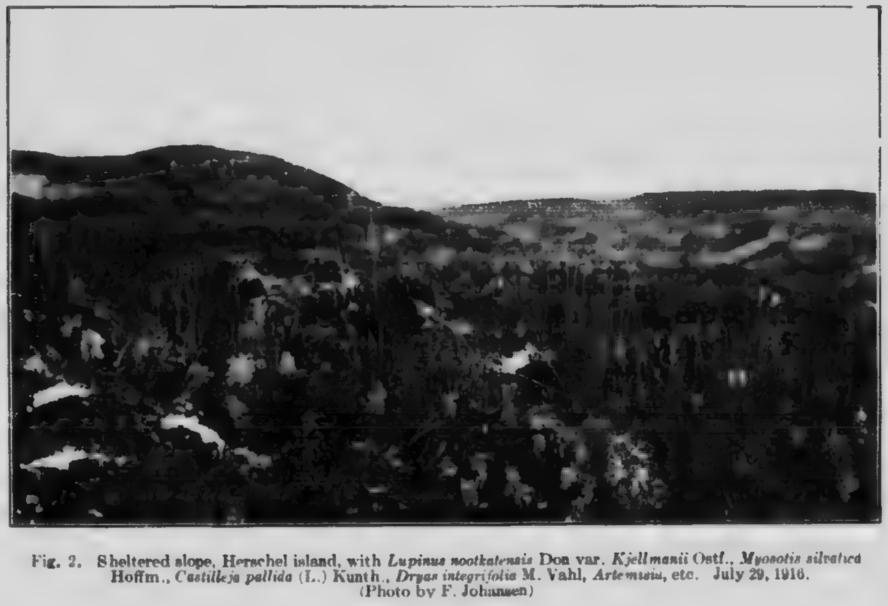


Fig. 2. Sheltered slope, Herschel island, with *Lupinus nootkatensis* Don var. *Kjellmanii* Ostf., *Myosotis silvatica* Hoffm., *Castilleja pallida* (L.) Kunth., *Dryas integrifolia* M. Vahl, *Artemisia*, etc. July 29, 1916.
(Photo by F. Johansen)

PLATE VI

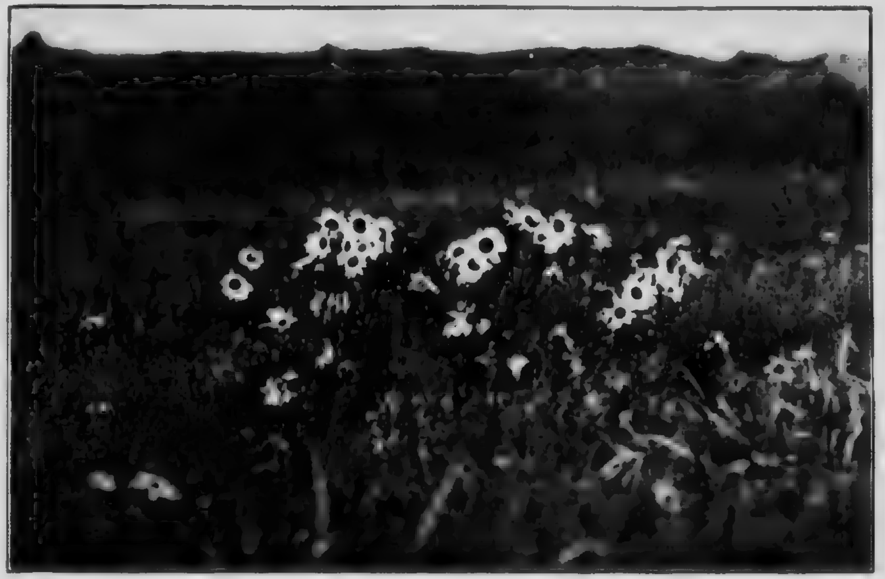


Fig. 1. Herschel island, August 4, 1916. Clump of daisies, *Matricaria inodora* L. var. *grandiflora* (Hook.) Ostf (Photo by G. H. Wilkins)

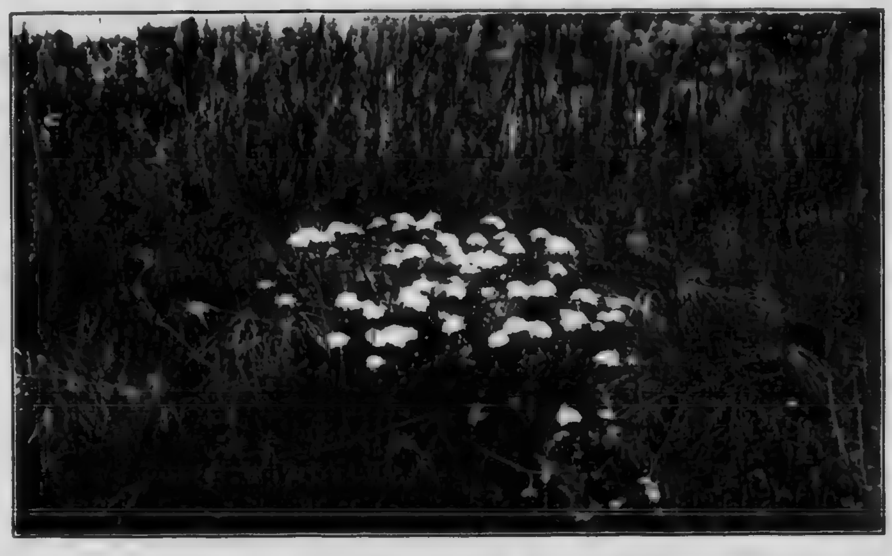


Fig. 2. Herschel island, July 29, 1916. *Achillea borealis* Bong. with *Artemisia vulgaris* L. var. *Tilesii* Ledeb., *Myosotis silvatica* Hoffm., *Ranunculus affinis* R. Br. (Photo by F. Johansen)

PLATE VII

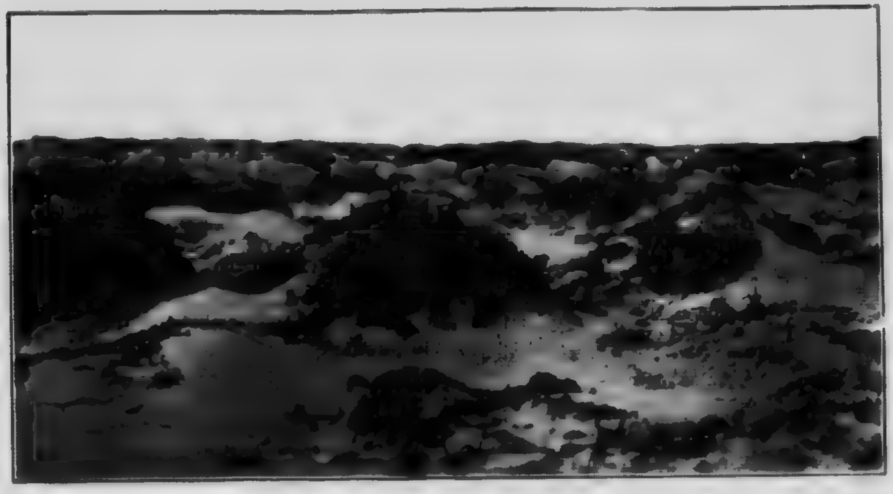


Fig. 1. Sandy slope at Bernard harbour, Dolphin and Union strait, Northwest Territories. *Hedysarum Mackenzii* Richards., *Dryas integrifolia* M. Vahl. August 4, 1915. (Photo by F. Johansen)

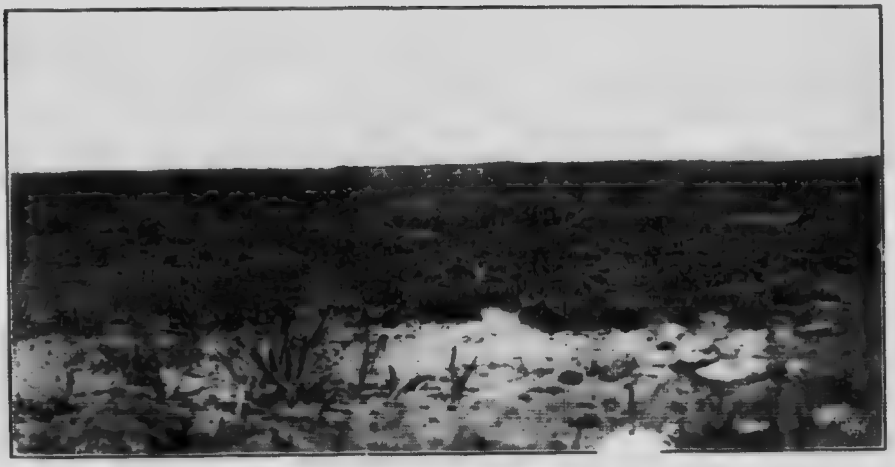


Fig. 2. Sandy slope, Bernard harbour, July 19, 1915. Staminate flowers of *Salix anglorum* Cham. (Photo by F. Johansen)

PLATE VIII

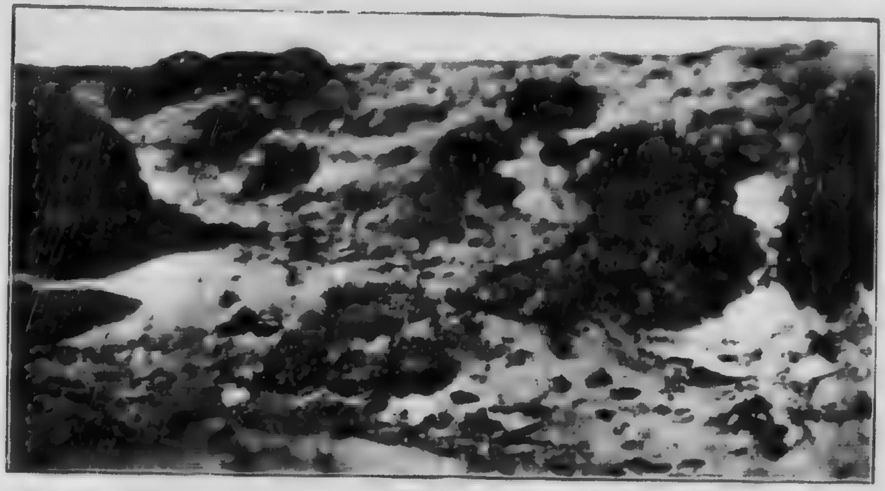


Fig. 1. Sandy slope, Bernard harbour, August 4, 1915. Pillows of *Silene acaulis* L., with *Dryas integrifolia* M. Vahl
Photo by F. Johansen

Fig. 2. Hillside, Bernard harbour, July 15, 1915. White heather, *Cassiope tetragona* (L.) Don, with *Rhododendron lapponicum* (L.) Wahlenb., *Dryas integrifolia* M. Vahl, and *Pedicularis capitata* Adams. (Photo by F. Johansen)

PLATE IX

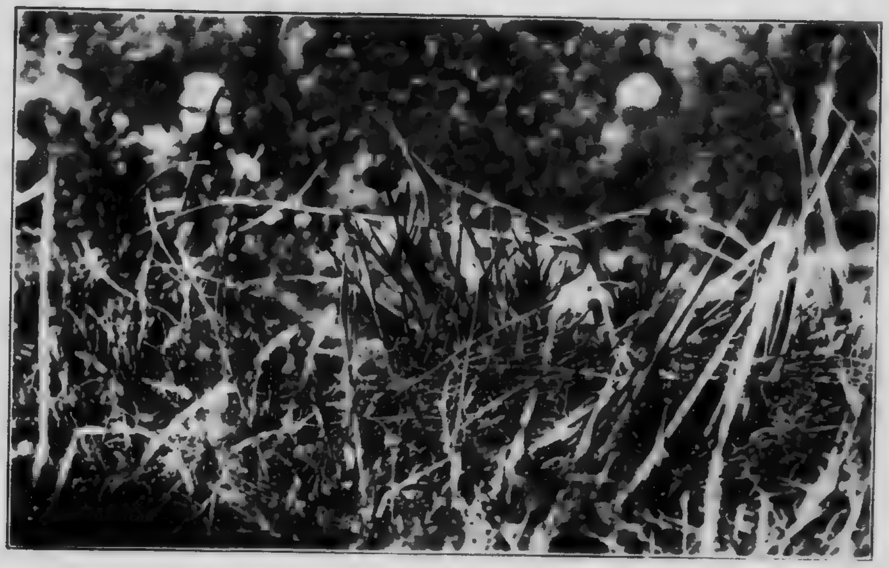


Fig. 1. Buttercup, *Ranunculus affinis* R. Br., in bloom on hillside. Bernard harbour, July 3, 1916. (Photo by R. M. Anderson.)

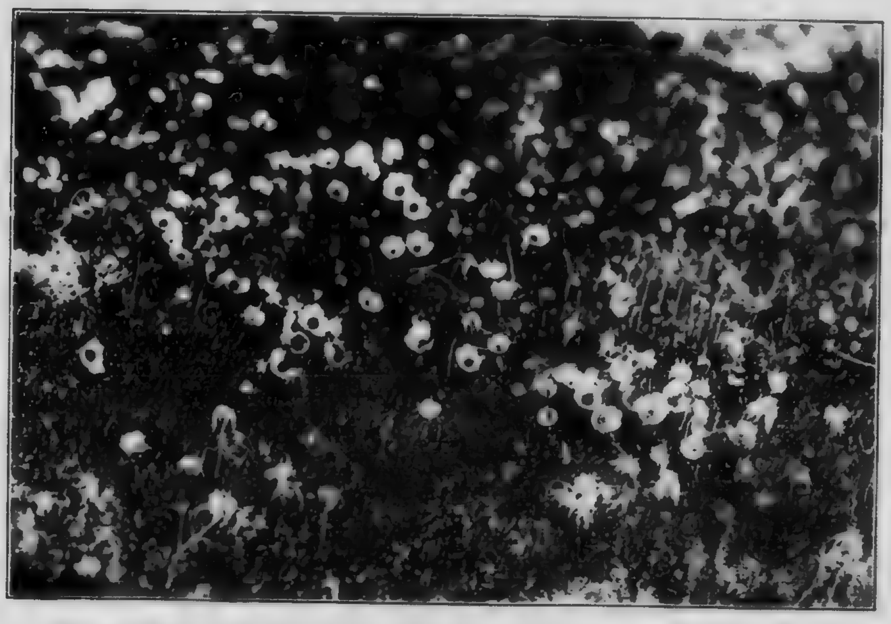


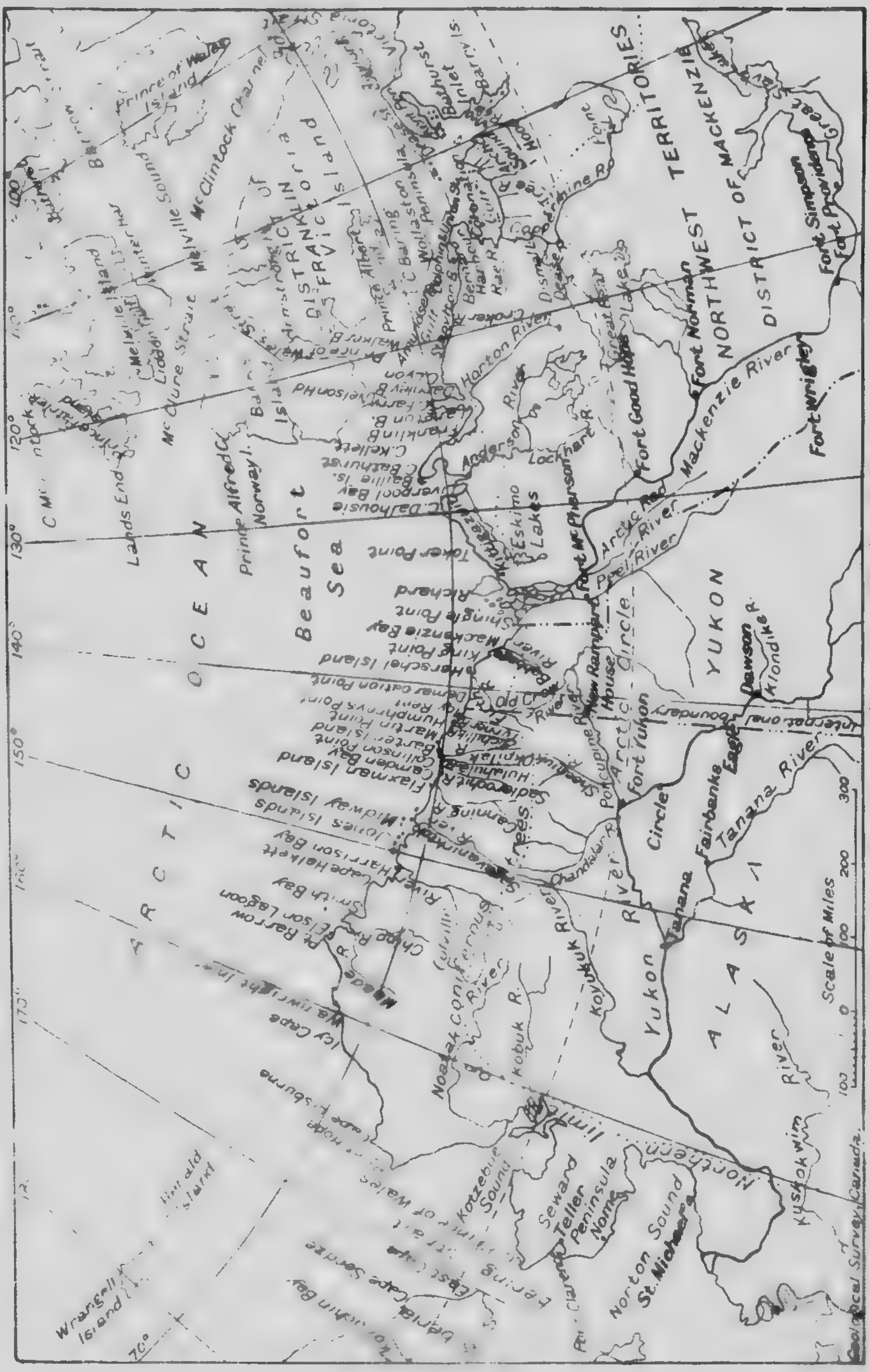
Fig. 2. *Dryas integrifolia* M. Vahl, in bloom on dry hillside. Bernard harbour, July 3, 1916. (Photo by R. M. Anderson.)

PLATE X

Fig. 1. *Cerastium alpinum* L., growing by nest of Pacific eider, near Cockburn point, Northwest Territories, July 15, 1916. (Photo by R. M. Anderson.)

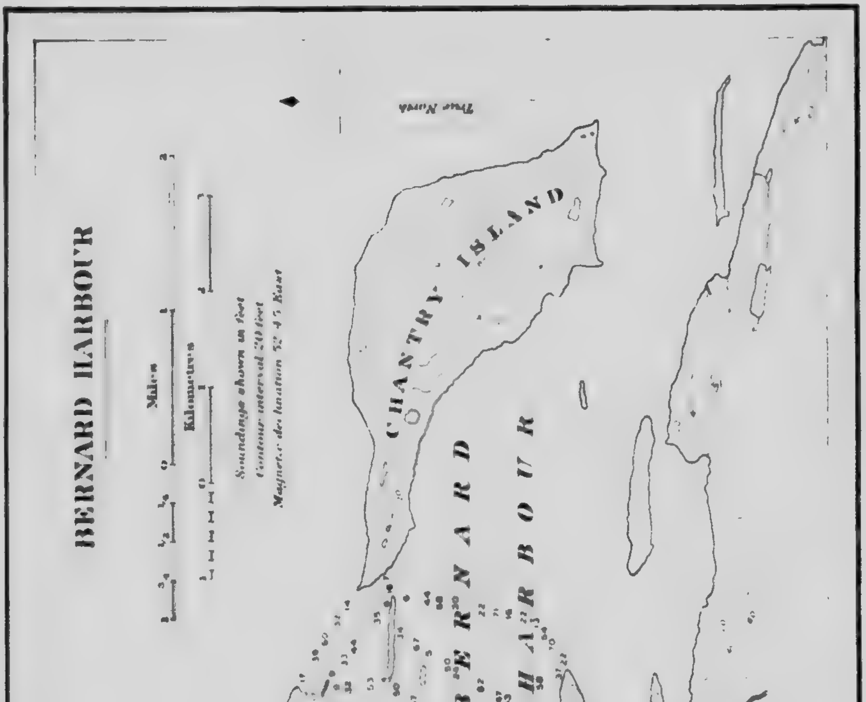
Fig. 2. Flowering tufts of *Senecio palustris* [illegible] Hook. var. *congestus* (DC.) Hook., growing in wet spot on small stony island [illegible] eider duck rookery off Cockburn point, July 15, 1916. (Photo by R. M. Anderson.)

PLATE XI



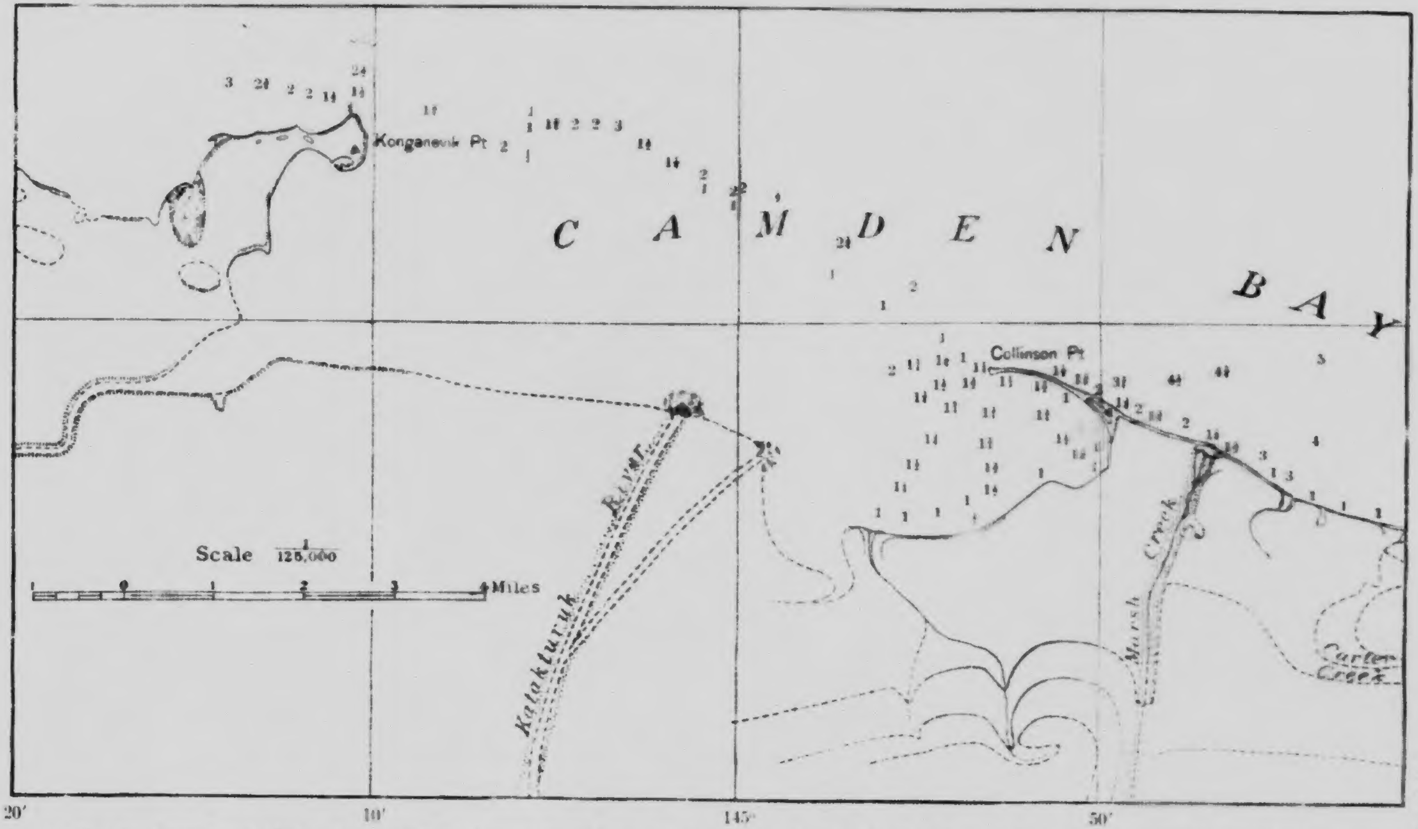
Western Arctic Coast of America; Canadian Arctic Expedition, 1913-1918

PLATE XII



Bernard Harbour, Dolphin and Union Strait, Northwest Territories

PLATE VIII

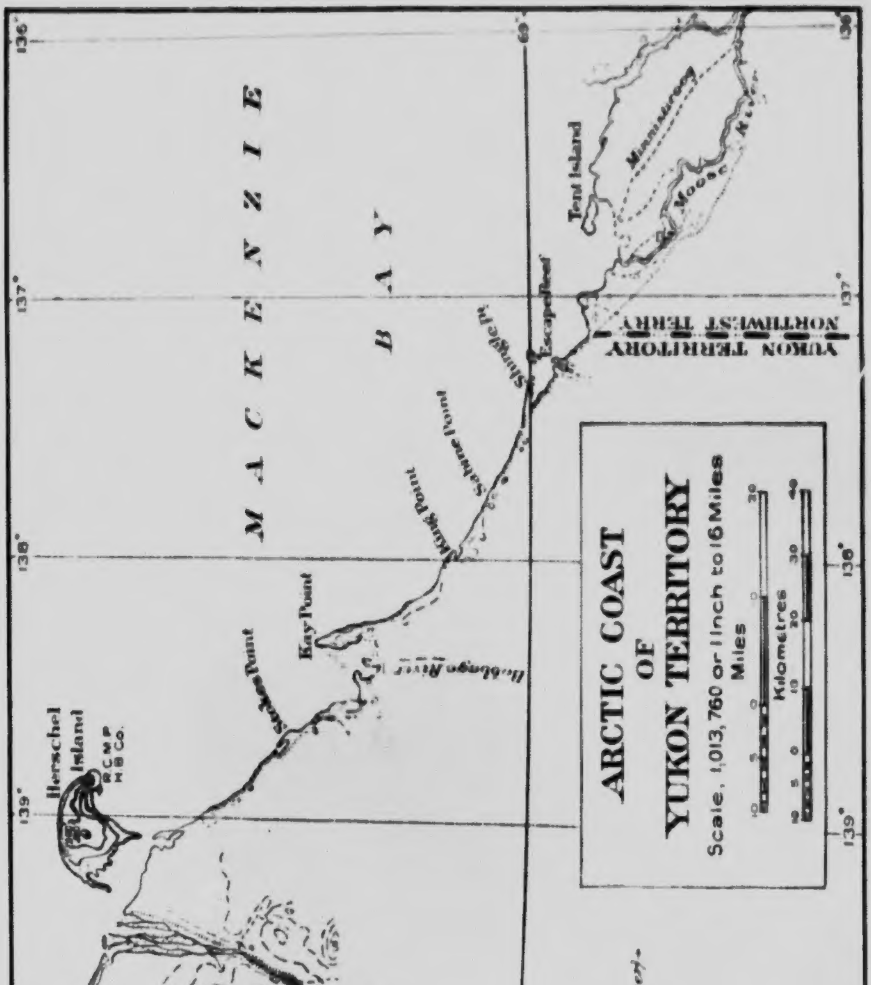


Camden bay, Arctic coast of Alaska. From Plate V, the Canning River Region, Northern Alaska, by Ernest de K. Leffingwell, Professional Paper 109, U. S. Geological Survey, Washington, 1919. Soundings shown in fathoms

ADQ 7359

Arctic Coast of Yukon Territory

PLATE XIV



From map 1963 Geological Survey Canada.

Arctic Coast from the Alaska-Yukon Boundary to Mackenzie Delta